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The Pollution of New York Harbor.

The pollution of the harbor of New York by sewage has been attracting the spasmodic attention of the public for some years. At the present time the contamination of the water from this source is not serious. At some places along the water front of Manhattan and the two Long Island boroughs offensive conditions can be found at low tide. When dredging is done in the docks of some parts of the harbor, the odor from the accumulated sewage sludge is very disagreeable. As a whole, however, the conditions are not such as to arouse any serious apprehension. It is necessary, however, to look far into the future in discussing what can and cannot be permitted safely regarding the disposal of the sewage of the districts tributary to the harbor. The enormous growth of manufacturing that will soon be evident in the New Jersey suburbs, the development of the commercial interests of Manhattan and the opening up of new districts for residential purposes by the rapid transit lines of several railway companies, will make this territory around the head of New York harbor a group of communities having a total population so great that even moderate estimates carefully prepared seem like wild dreams when printed. Few people realize the remarkable development of industries in the vicinity of the harbor that is taking place now, or appreciate the important statement made from time to time by immigrant officers that a very large proportion of the host of people arriving every week in New York from Europe stay in the vicinity of the city.

The discharge of sewage into New York harbor threatens to have three undesirable consequences. It may cause offensive odors and injure the appearance of the bay, which is largely used by excursion vessels in the summer; it may cause a serious contamination of the oysters and clams obtained in its water, and it may produce deposits of sludge which will eventually cause unsanitary conditions.

Whether it will do all this depends upon the volume of the sewage, the places at which it is discharged, and the tidal currents of the waters receiving the sewage. It is certain that even today the sewage-laden condition of the waters from which clams and oysters are taken is a serious matter. This is the most pressing problem to be solved just now, and on account of the important interests involved it must be approached with great tact. The other problems do not need such immediate attention.

The difficulty in bringing about any rational and broad solution of the whole question depends upon the division of authority over the harbor among two great states and the national government. No satisfactory plans can be worked out except with the complete co-operation of these three authorities, and anybody who has endeavored to obtain such united action knows the extreme difficulty it involves. The people of New Jersey believe that they have the right to discharge as much sewage into the harbor as suits their convenience. The people of New York, particularly the growing population on Staten Island and parts of Brooklyn, are up in arms against any such claim, while the government at Washington must safeguard the interests of navigation. This broad view of the subject is that taken by the New York Bay Pollution Commission, which has just made a report reviewed elsewhere in this issue. This report advises the appointment of a Metropolitan Sewerage Commission of the State of New York to carry on an investigation of the pollution of the harbor and make studies for its prevention, co-operating in this work with a similar commission representing New Jersey, if that State can be persuaded to take a similar action. It is estimated that three years will be required for a satisfactory investigation of this kind, and this, perhaps, is too short a time in which to complete a study of the tides, of the future population of the territory and of the many sewerage systems which must be sketched out with considerable care before any definite studies of the final disposition of the sewage can be completed. In the report just presented, it is suggested that the best method of preventing pollution will probably be the construction of great outfall sewers into the ocean. Such a suggestion is interesting, but until data for a solution of the problem are collected it is unsafe to form any decided opinions on this head. The pressing problem is to secure a joint commission, or co-operating commissions, representing all three parties having authority in the subject, and to give this commission ample powers and financial support for a thorough and comprehensive investigation.

Cost-Plus-Fixed-Sum Contracts.

A few weeks ago attention was called to the system of letting contracts for large work on the basis of the cost plus a fixed sum. The advantages of such a method, so far as they relate to the economical expenditure of money, were pointed out at that time. There is another aspect of such agreements, however, an important one that is discussed below by Mr. Walter C. Kerr, president of Westinghouse, Church, Kerr & Co.; it is the tendency of the system to harmonize the interests of those who furnish capital and those who execute work. Such a result is so manifestly desirable that the approval of the system on this ground, by an engineer of Mr. Kerr's experience, deserves special attention.

The Engineering Record for April 1 contains an interesting editorial on "Cost Plus a Fixed Sum," based upon the method employed by Mr. Gilbreth. I think your allusion to this is timely. The practice as conducted by Mr. Gilbreth is excellent and should be more widely extended. This method has in various forms been more or less followed by contractors for at least ten years, and it has long been practiced and regarded favorably by engineers who perform rather than supervise constructive operations for their clients. It should not, therefore, be regarded so much as a novelty as is perhaps reflected by your editorial, but rather in a higher sense as a substantial growth of a well-founded practice and which will grow in favor the better it is understood.

It is obvious that an agreement to do work on cost plus a fixed sum means substantially cost plus an agreed percentage on the estimated cost, for the fixed sum will always be reckoned approximately upon the assumed cost, which experienced constructors can predetermine with much precision.

This plan does not differ widely from the percentage form of contract in which the compensation is based upon the final cost, and it is a matter of preference and agreement which method shall be used. It is well known that in certain classes of work it is quite impossible to predetermine the cost with sufficient accuracy for a fixed-sum-profit method, especially in extended operations the magnitude of which cannot be predetermined by the principals.

In addition to the features so appropriately mentioned in your editorial, there is a deep and fundamental reason for this type of relationship between those who want something done and those who know how to do it. Past practices in contracting have caused too great a separation between the customer and constructor. They have been widely separated by diversity of interest, and the contracting methods have tended to produce greater diversity of interest. At the best, they involve the necessity of some one who wants something done, and has the money to pay for it, turning over the work almost to the mercy of some one whose chief interest is to do it as cheaply as possible and make all he can. If perchance the contractor is high-minded and liberally disposed, as some certainly are, he will perform excellently, even better than he agrees. Unfortunately, few will do this, and many who do it seem to drift away from the older forms of contracting into the various percentage plans in which they come into closer and co-operative relationship with their client—some as contractors, others as constructing engineers.

It is not feasible to prescribe any man's full duty by plan and specification and it is still more difficult to enforce it. There is no other very good way either. Consequently there must be brought about a relationship in which the duty will be done because it is best to do it and so that all interests are profitably served thereby. Then it becomes easy, and any plan which brings the customer and the constructor, whether he be engineer or contractor, into such close relationship that their interests are mutual permits the possibilities of combined capital and talent to work out their best results.

I therefore wish to add this word to your expression regarding this class of relationship because it is good. No matter who is carrying it out or the exact method followed, it is in the right direction and will be found better adapted than any other plan yet devised for the general conduct of engineering and contracting service.

Walter C. Kerr.

Supervision of Public Service Corporations.

Some years ago, while Mr. Tom Johnson was at the head of the Nassau electric railway system in Brooklyn, he addressed a political meeting in that city in support of municipal ownership of all public service undertakings. His frankness at that time caused consternation among the party managers. He told his audience, assembled to hear him attack the bad gold bugs of the opposite party, that the trouble lay right at home among them. He assured them that they were fools, and that they were giving away almost priceless privileges for little or nothing. He said he would be an equally big fool if he did not take these privileges and build street railways as he did; if he did not somebody else would, and he considered that the money to be made might as well come to him as to anybody else. He felt sorry for people who would allow such franchises as he held to be given away as they were, but so long as the people continued to be foolish in these matters, he intended to profit by it. The speech was probably one of the most extraordinary ever made before a political audience, but the idea that was at the bottom of it is expressed in a report on the public lighting service in New York, of which an abstract will be found in the Current News Supplement of this issue.

The recommendation of the legislative commission to reduce by law the maximum price for gas and electricity in New York is a very serious one, not to be hastily dismissed with a brief comment. A very large part of the argument for the step hinges on other considerations than those of engineering, and for this reason it is needless to go into the matter in this place. It seems desirable to point out, however, that the commission making this recommendation failed, like other commissions for a similar purpose, to take into account a very serious cause for what is an unnecessary capitalization of some public service corporations if the legitimate capital investment is regarded solely from the point of view of the money needed to build and operate a plant. In the work of these public service corporations there is an ever present danger of the inroads of financial pirates. These men secure franchises enabling them to compete with the established companies, build unnecessary plants and carry on a predatory warfare until they are bought out. To buy them out it is necessary to make large additions to the capital stock of the established company. This additional stock is in no sense water, as the New York commission seems to regard it, but it is an indebtedness incurred through the praiseworthy determination of the directors to protect the rights of their stockholders.

There is one feature of the commission's report which is a good one, if it can be carried out with a due regard to all the interests it will affect. This relates to a State commission to supervise the public service corporations, from their incorporation to their demise. Massachusetts has a commission which looks after the railways of the Commonwealth and another that is concerned with the lighting undertakings. These bodies have exercised a control on these classes of public service which has been wholly beneficial. They have prevented the wasteful granting of franchises which Mr. Johnson criticised and profited by, and they have regulated charges for lighting while preventing the organization of unnecessary competing lighting companies. Unrestricted competition is as bad for public service as monopoly, and Massachusetts acts on this view. Such a commission is needed as much to protect the companies as to safeguard the public interests. The amount of money lost annually by improper competition among public service corporations must be enormous, and it is important to check this competition so as to insure safety to the capitalists who have invested in good faith in the undertakings. If this competition is not prevented, the rates for lighting will inevitably and legitimately be kept above those ample to ensure a reasonable return on necessary expenditures for plant and operation. A logical analysis of high rates will generally show that they are due, as Mr. Johnson stated, to the foolishness of the public or its representatives.

Formulas for Concrete-Steel Beams and Other Members.

The use of concrete-steel construction for beams and other forms of construction has raised many questions as to the practicability of establishing simple but safe formulas for use in design work. While this observation bears particularly upon the use of concrete-steel for floor purposes and in other applications where flexure is the principal state of stress to be provided for, it is equally true of every application of this combined material. In the employment of any such formula it must obviously be assumed that both the concrete and the steel will be used in that condition of excellence on which the formula is either implicitly or explicitly based. This is a feature of the design of concrete-steel members which is not always made sufficiently prominent. Whether a formula is exact in its expression or loosely approximate, even, is not a matter of vital importance if the concrete is of reasonably excellent quality, and is properly put in place with the embedded steel. If, on the other hand, the formulas are accurate to the last degree while the material used is indifferent or poor in quality, failure of the structure is likely to result, as has unfortunately been the case in altogether too many instances during the past two or three years. No accuracy in formulas will redeem poor material or cure ignorance.

The use of concrete-steel for the walls of buildings and for a number of other purposes reasonably within the scope of application of that material has in some quarters been pushed with a reckless disregard of what is plainly requisite in that field of construction. The legitimate employment of so excellent a material, when properly made and used, has but begun, and it is all the more unfortunate in this early stage of its use that ignorant or unscrupulous procedures, or both, should obscure its real character and jeopardize its rapidly spreading utility in work designed and executed by competent engineers.

The fact that concrete-steel has not only come to stay, but also to stay as a most effective structural material under constantly increasing demands both as to the field it is to occupy and as to the intensity of duties it must perform, makes it imperative that the formulas on which designs are made should be reasonably accurate and sufficiently simple to be susceptible of easy use. If it can be assured that concrete-steel shall be of as good quality as the best grades of Portland cement can make it, it is easy to establish formulas which are simple in character and at the same time sufficiently accurate for all practical purposes. As a matter of fact formulas for concrete-steel beams are the only ones which are to any extent complicated in character. The additional fact, however, that concrete floors, i. e., plate beams, with or without ribs, are at present extensively used, gives this class of formulas unusual importance.

This problem of the flexure of a composite beam is not a new one among engineers. It is well treated already by a number of excellent engineering authorities; but it is not out of place to refer to one or two features of the general problem. In the first place the distribution of stress in either all concrete or all steel beams is fairly well known, and its law forms the basis of what is ordinarily called "the common theory of flexure." The intensity of the stresses of tension and compression in the two portions of such beams varies directly as the distance from the neutral surface. A sufficient amount of experience has been accumulated in the actual testing of concrete to show that that law holds at least within the limits of stress conditions that ever occur in concrete or concrete-steel beams in completed structures, in spite of the apparent defects in the elastic condition of even the best Portland cement concrete. This is a fundamentally important fact, for it completely justifies the application of the common theory of flexure and its resulting formulas to concrete-steel beams, just as they are applied to beams of each of those materials. Further than this, the actual tests of concrete in tension and compression show that there is no reasonable ground for introducing one modulus of elasticity for concrete in tension and another for the same material in compression, although efforts have been made to introduce that difference. Finally, if it be desired to omit the resistance of concrete to tension in the composite beam, it is entirely rational to make the corresponding modification in the formulas. This is a safe and judicious assumption; it not only removes any objection which can be made to submitting masonry to tension, but it also simplifies the formulas.

The preceding considerations are all entirely rational and are not "approximating" in character, but they point the way to approximate formulas that are both safe and accurate to a high degree. It is only necessary to remember that the tensile and compressive stresses in a solid beam may each be considered equivalent to a single force applied at their center of action. The moment of the stresses themselves would then be represented by the moment of the two equivalent forces acting with a lever arm equal to the distance between the stress centers. In the case of the composite beam the single tensile force is the stress in the steel bar, while the compressive force is the compression in the concrete acting at its center. The lever arm of the stress couple is the distance between the center of the steel and the center of action of the compression in the concrete. This latter is taken as seven-eighths of the distance from the top of the beam to the center of the steel bar by Mr. H. A. d'O. Saurbrey in his communication to The Engineering Record two weeks ago. Mr. Saurbrey's formulas, therefore, and others derived in an equally rational way, are well founded, and should produce practically accurate results. It is necessary where numerical quantities are introduced for purposes of close approximation that they should be tested in a sufficiently large number of instances to show that they are adaptatious of practical accuracy, within the extreme limits of their use. It is entirely feasible to deduce simple and essentially accurate formulas for concrete-steel members, wherever it may be desirable to do so, in this thoroughly rational and satisfactory manner.

The Union of Harvard University and the Massachusetts Institute of Technology.

The project for associating Harvard University and the Massachusetts Institute of Technology has been formally placed before the alumni of the latter college for a letter ballot. It is a project that has met with serious opposition among the graduates of both institutions, as is natural in the case of any proposition involving such changes, no matter how great may be the advantages to accrue from it. It is inevitable that the views of the subject held by those previously connected with the two colleges should be colored by their recollections of what has been, although the correct spirit in which to approach it is from the viewpoint of the future, the effect of the alliance on those educational principles for which the two schools have stood sponsors in the past and toward which they wish to occupy a similar position in the future. It is the student body of the future that will gain or lose by the merging of interests, and the discussion should hinge upon their welfare. An attempt to make the decision depend upon the effect on the alumni of such a merger is hardly warranted, because after graduation the good that a school can do one of its men is largely sentimental and dependent on the influence for better work and higher ideals of life that were implanted during undergraduate days.

The development of the Institute has been a grand work of high achievement, reflecting credit on the whole educational system of the country as well as on the trustees and faculty who accomplished it. This journal believes, however, that the development has been carried as far along practical lines as the interests of the country demand. There is a great need for a high-grade technical school in the Boston district, but there is a greater need at the present time for opportunities for purely scientific instruction along lines touching engineering, but not influenced by its utilitarianism. The engineer must be, above everything else, a business man; he must see every problem with the eye of the investor of money as well as the eye of the designer and builder of works of utility. On the other hand the scientist must not be confined by limits of usefulness for the results of his research. He must carry forward the boundaries of our knowledge without regard to the effect of advancing them. That is being done in all the great universities of the world. Unfortunately a great deal of the progress remains useless for practical purposes; it is not interpreted so that men can readily use it. The scientist and the engineer are not acquainted personally; they do not interchange those confidences regarding their work which enable each to help the other. The engineer looks upon and ridicules the scientist as impractical, and the scientist regards the engineer as a grubber in the dirt, whose soul is devoid of the fire of scholarly imagination, without which real progress is impossible. Both views are incorrect in a measure, and the greatest need of technical education as well as pure science today in this country is an intimate acquaintance between the two classes of men. The place for this acquaintance to begin is in the college, and consequently this journal believes that a merging of the fine scientific spirit of Harvard with the sound, practical spirit of the Massachusetts Institute is highly desirable. It will make engineering better, and it will tend to shorten the time within which the progress of science becomes useful for practical purposes.

The subject has, however, a practical side that must not be overlooked. The facilities of the Institute are now so crowded that it must refuse to take more students or must erect new buildings. To do the latter in the heart of Boston is almost out of the question, and it is consequently necessary to look for a site elsewhere. The suggestion to make the new home of the Institute on the right bank of the Charles River as nearly as practicable opposite Harvard Square is an excellent one, whether the alliance is carried through or not. The more the students of the two institutions mingle the better off they will be. Breadth of view does not come from studies or class exercises, but only by acquaintance with men of many classes and purposes. The geographical association of the two great institutions is desirable for this reason, apart from any other.

Financially the alliance seems to be almost essential to the future of the Institute. An examination of the published data concerning the Institute's monetary affairs shows that it has a considerable debt, and there is every probability of an increase in it. On the other hand Harvard has great resources for education of a technical character. These are so ample as to make certain the pre-eminence of the technical school which is supported by them. Harvard offers to give them to the Institute, for its use, provided the Institute will co-operate with Harvard in certain ways, which are of very small moment compared with the importance of the advantages she offers. Harvard will give up the Lawrence Scientific School, if the alliance is formed, and in other ways will use her good will to make the Institute successful as a school of applied science. In return for all this Harvard will receive no direct benefit. Indirectly she will have the great advantage of a neighborly community of interest with a great school having the same spirit of high endeavor in applied science that has always marked Harvard's views of the duty of educated men. She will also be spared the unpleasantness of using her enormous resources in building up the Lawrence Scientific School into a great department of university work, which will overshadow the school at Boston.

Outsiders, looking at the subject impartially, have repeatedly commented in warm terms on the magnanimity that Harvard is showing in this matter, which is not properly recognized by Institute alumni who urge that an alliance with Harvard will destroy the Institute spirit. Just what is meant by that term cannot be said, but if it refers to any feeling that instruction in the Massachusetts Institute is any better and broader than that at Harvard and a good many other institutions it is distinctly erroneous. If schooling is worth anything it ought to break down such a feeling, and make the young men who go out into the world quick to recognize the good attributes of all with whom they come in contact, without regard to what school pin they wear. Consequently the fear that the Institute spirit will suffer by the alliance is one which does not have much weight with those who see a really noble spirit on Harvard's part in offering to set aside her opportunity to build up a great school of applied science, excelling in its resources anything in the country, in favor of the Institute. Looking at the matter without personal prejudice for or against either institution, the project seems to be one in which Harvard gives all the advantages, and these advantages are so great that they should be accepted as soon as possible, lest the Harvard authorities withdraw them.

Notes and Comments.

A Septic Tank System has been built at Hawkesbury College, Sydney, N. S. W., to deal with the sewage of 200 people. There are two covered 15x7x8-ft. septic tanks, from which the sewage passes to a 14x10-ft. stream filter 8 ft. deep having six corrugated Stoddart distributors. Gravel is used for the filter; its sides are battered 1:6 and protected with a 9-in. brick wall having open joints. The filtrate is collected in a pit, from which it is forced by an electrically-driven centrifugal pump to the college farm. This is the first continuous streaming filter in Australia and cost £600.

Tests of Full-Size Masonry Columns of brick and concrete, with and without reinforcement, have been in progress for some time at the Watertown Arsenal, and some of the interesting results already obtained are stated elsewhere in this issue in a paper by Mr. James E. Howard. In the case of concrete, the mixtures and methods of reinforcement will comprise, it is understood, the use of longitudinal bars imbedded in the columns, thus adding to the strength by their direct compressive resistance, and also reinforcement by hooping or its equivalent, according to the various current methods. The tests are intended to be comprehensive and engineers employing special reinforcing materials are cöoperating in extending the scope of the work. The behavior of the columns is observed during the progress of testing, and the data obtained, it is thought, will be useful in connection with the results of beam tests as an indication of the probable behavior of the material on the compression side of the neutral axis, in addition to its value in the more restricted field of compression members. The full details of these tests will appear in the reports of "Tests of Metals," issued by the Ordnance Department of the army. The value of the work that is being done by Mr. Howard is very great, and the full data concerning the results of his tests which the Ordnance Department publishes make the experiments of exceptional interest to engineers. Up to the present time the Government has not seen fit to print any discussion of the tests, leaving engineers to interpret them as they choose. Consequently the unofficial papers discussing the results, which Mr. Howard occasionally prepares, merit unusual attention.

Pensions for Teachers in "the universities, colleges and technical schools" of the United States, Canada and Newfoundland have become possible through the creation of a fund of $10,000,000 for the purpose by Andrew Carnegie. The financial administration of this admirable enterprise will be entrusted to twenty-five trustees and the donor hopes "that the fund may do much for the cause of higher education and remove a source of deep and constant anxiety to the poorest paid and yet one of the highest professions." This recognition of the weakest feature of higher education in America deserves the heartiest approval. Pension funds have been provided in a moderate way in a few universities, and President Pritchett, of the Massachusetts Institute of Technology, devoted some attention to their importance in one of his recent annual reports. The lack of such a pension fund has kept from the faculties of our colleges many men who would have done admirable work but could not afford to risk the future on the small and uncertain salaries paid to teachers at present. It may be of interest to know that Harvard pays the highest salaries, averaging $2,900, and that the average in the whole country is about $2,000. It is asking too much of the men who have the attainments necessary for the most success as teachers to accept any such salaries unless there is some pension provision. Mr. Carnegie has supplied the money for the latter purpose, and has thereby done a great deal for education. Now let us hope that the trustees of all our universities and colleges will be equally generous, and allow the members of their faculties to earn money by the practice of their professions or in other legitimate ways that do not interfere with college duties.

Repairing a Broken Levee Three Miles from Sacramento.

THE RECLAMATION OF ONE MILLION ACRES OF SWAMP LAND IN CALIFORNIA.

By Rufus P. Jennings, President, River Improvement and Drainage Association of California.

While it is perhaps not the part of The Engineering Record to present plans for the future accomplishment of an engineering feat but rather to show the nature of the plans by which any given engineering work of difficulty or magnitude has been accomplished, yet, in the case of a work of great importance which has been undertaken in California the plans are worthy of recognition, as the actual construction work will, undoubtedly, proceed along the lines now laid out.

For an almost uninterrupted series of years the Sacramento River in California has overflowed its banks or burst through its levees, flooding the land, suspending commerce and causing a loss to property owners of many millions of dollars. Although an amount estimated at twenty millions of dollars has been expended in levee work and river improvement it has not resulted in permanently bettering the condition of the Sacramento River or the lands adjacent to the river. The reason for this is there has been no broad plan for all the region affected which has been consistently followed, a reason which will, perhaps, appeal more to engineers than to the general public. Attention has been mainly devoted to levee work rather than to the improvement of the channel of the stream whose flow at times has become too great for the normal channel and has flowed over or broken through the levees meant to confine it. The general plan recommended by a commission of engineers and adopted by the River Improvement and Drainage Association of California consists in ultimately concentrating the flow of the Sacramento River into one main channel controlled by large levees at a distance of 1,000 to 1,600 ft. apart and extending from Chico Landing down to Collinsville, with temporary by-passes on the east and west to be used as overflow channels until the main channels shall be able to carry all the flood waters. These channels will be used thereafter as drainage canals.

The situation in California is briefly as follows: Two approximately parallel ranges of mountains in California, the Sierra Nevada and the Coast Range converge at Mount Shasta in the north and at Tehachapi in the south. These ranges embrace a great area, often called the Great Valley of California, 400 miles in length and varying from a few miles to 80 miles in width, having an average width, however, of 40 miles. The Great Valley is a gently sloping and practically unbroken plain with a total area of 15,700 square miles, or 10,048,000 acres. The entire basin including mountains and valleys covers an area of more than 58,000 square miles. The northern portion of this area is drained by the Sacramento River and the southern portion by the San Joaquin River. These two rivers unite and flow into Suisun Bay, a branch of San Francisco Bay. The Sacramento River takes its source partly from tributaries which head in the southern and eastern slopes of Mount Shasta and partly from the McCloud, Feather and Pit Rivers and other streams. Thence it runs south in the Sacramento valley in a course parallel to the Coast until it reaches Sacramento City, where it runs northeast to Suisun Bay. The river proper is about 250 miles long. The Sacramento valley extends from 38 deg. to 40 deg. 10 min. north latitude and from 121 deg. 10 min. to 122 deg. 20 min. longitude west from Greenwich, being about 140 miles in length by 40 miles in width. The valley is fertile and grows practically every product of the temperate and semi-tropic zones. The Sacramento River was once navigable from its mouth to Red Bluff, a distance of a little more than 250 miles. Up to 1862 the Yuba, a tributary of the Sacramento, was navigable all the year for ships and boats drawing from 9 to 10 ft. of water, and during winter season deep-water ships and steamers from around Cape Horn navigated it to Marysville. Other streams were also navigable, but the deposits of silt as a result of placer mining and other operations have shoaled the channel.

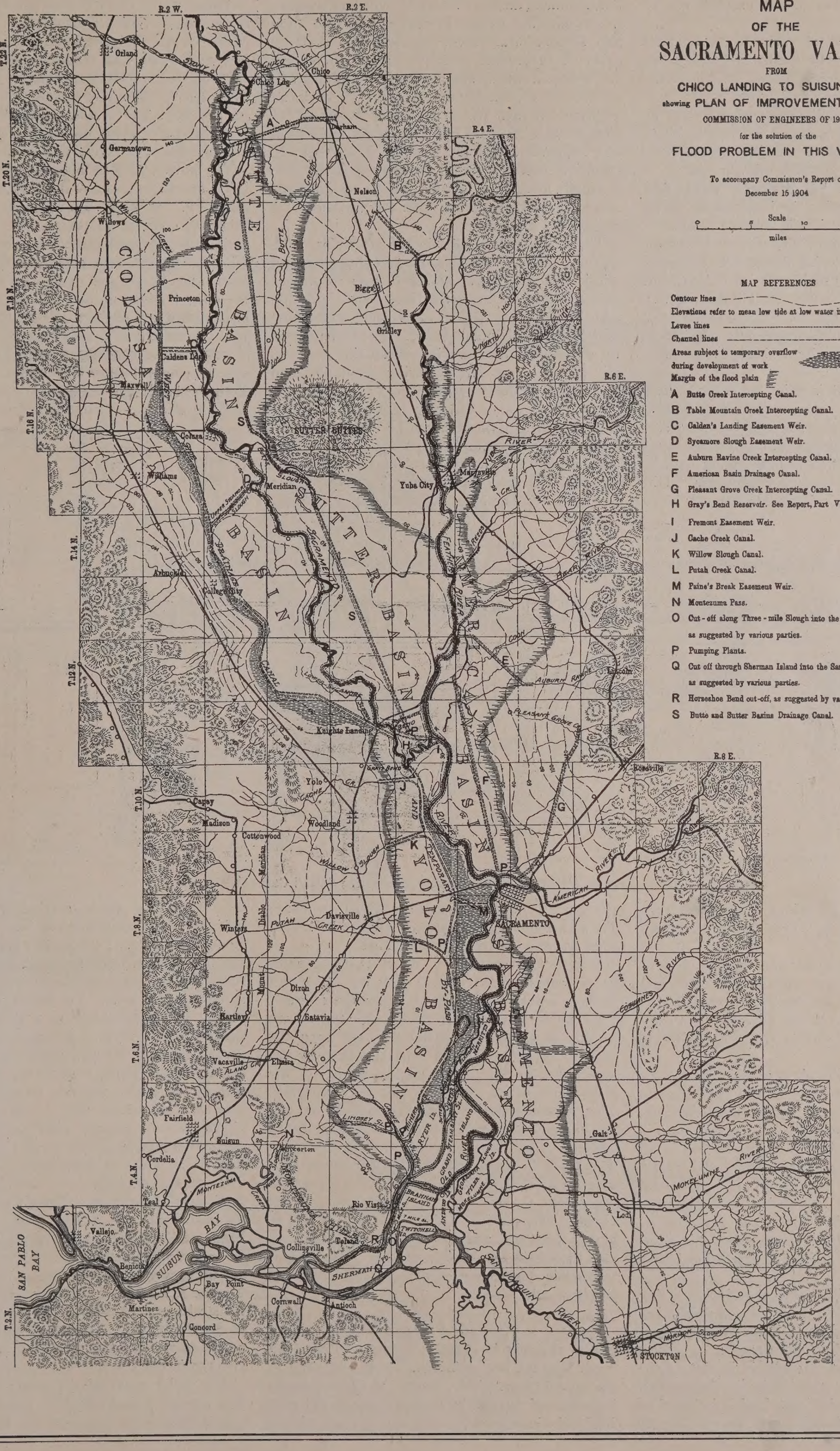
Sacking Sand to Repair a Broken Levee near Sacramento.

The foothills that flank the Sacramento valley on the east and west gradually converge north of Oroville and close around the valley near Red Bluff. These hills have been cut by the Sacramento River, which reaches the valley through a gorge known as Iron Canyon. The general elevation of the Sacramento valley at Red Bluff is about 300 ft. From this point the fall to the south for 60 miles averages less than 3 ft. to the mile. The slope in this direction gradually decreases until it is less than 0.3 ft. near Sacramento. The southern and eastern slopes of Mount Shasta are drained by tributaries of the Sacramento. The streams draining the Coast Range are subject to great floods of short duration during the late winter, but their summer flow is small. The elevation of the Sierra Nevada Mountains being greater than those of the Coast Range the temperatures are lower and much of the precipitation is in the form of snow. The flood stages from these sources occur, consequently, in the spring. The greater part of the summer flow of the Sacramento River is furnished by the Pitt, McCloud and Feather Rivers, the first deriving its sources from a plain-like region known as the Lava Beds. In September, 1902, the total flow of these streams, as determined by the low water measurements, was 90 per cent. of the low water measurement of the Sacramento River at Sacramento, Cal. A protracted heavy rainfall or warm rain or snow may cause the Sacramento River at Red Bluff to rise from almost low-water stage to the heights of ordinary floods. The mean flow of the Sacramento River for seven years from 1878 to 1885 inclusive was 25,936,258 acre-feet.

The problem presented, then, necessitates a plan providing for the heavy floods from the Sierra Nevada ranges when the flood waters reach the low slope near Sacramento where the fall is less than 0.3 ft. per mile. An extra difficulty was encountered in the fact that the low water of the Sacramento at this point is 90 per cent. of the low water of its tributaries, the McCloud, Pitt and Feather Rivers. The flood waters are an addition to the minimum low waters. In the Sacramento valley and contiguous parts of the San Joaquin valley, there are some 1,250 square miles of very fertile land that is subject to overflow from every considerable flood in the Sacramento River and about 1,700 from extraordinary floods.

In times of flood the waters of the Sacramento River rushing down to its confluence with the San Joaquin River at tide water back up and raise the level of both rivers for miles above the point of confluence. The singular but not unusual problem has often been presented when the river has thus broken through its banks, of the escaped water flowing north on the opposite side of the levee while the Sacramento River itself is rushing to the south. No better illustration than this could be given of the fact that a levee is only as strong as the weakest part. A means had to be determined of preventing the inundation of the flooded lands by conveying the water that passes through these lands harmlessly into Suisun Bay and to correct the existing floods of the river channels with a view of avoiding the floods and promoting the interests of navigation.

It has been found that all parts of the Sacramento flood plane are so connected with one another that they cannot be considered as independent units in any scheme of reclamation but must rather be treated as a whole. Each portion of the territory is, therefore, included in the general



MAP
OF THE
SACRAMENTO VALLEY
FROM
CHICO LANDING TO SUISUN BAY
showing PLAN OF IMPROVEMENT presented by
COMMISSION OF ENGINEERS OF 1904
for the solution of the
FLOOD PROBLEM IN THIS VALLEY

To accompany Commission's Report of
December 15 1904

Scale 0 5 10 15 miles

MAP REFERENCES

Contour lines
Elevations refer to mean low tide at low water in Suisun Bay.
Levee lines
Channel lines
Areas subject to temporary overflow during development of work
Margin of the flood plain

A Butte Creek Intercepting Canal.
B Table Mountain Creek Intercepting Canal.
C Calden's Landing Easement Weir.
D Sycamore Slough Easement Weir.
E Auburn Ravine Creek Intercepting Canal.
F American Basin Drainage Canal.
G Pleasant Grove Creek Intercepting Canal.
H Gray's Bend Reservoir. See Report, Part VIII, paragraph 10.
I Fremont Easement Weir.
J Cache Creek Canal.
K Willow Slough Canal.
L Putah Creek Canal.
M Paine's Break Easement Weir.
N Montezuma Pass.
O Cut-off along Three-mile Slough into the San Joaquin, as suggested by various parties.
P Pumping Plants.
Q Cut off through Sherman Island into the San Joaquin, as suggested by various parties.
R Horseshoe Bend cut-off, as suggested by various parties.
S Butte and Sutter Basins Drainage Canal.

scheme and all reclamation work within its limits will be in conformity with the flood plane embracing the entire valley.

The plans presented by a commission of engineers for the solution of the problem are as follows:

(a) To confine the flood waters to the channels of the various streams by means of levees so as to prevent destructive inundations of the fertile valley lands.

(b) To correct the alignment of the river by cut-offs where necessary, and to increase its channel capacity by mechanical means wherever current action fails to accomplish this purpose.

(c) To collect the hill drainage, which now loses itself in the basins, in intercepting canals and convey it into the river at selected points.

(d) To provide escapeways over the levees for surplus flood waters during the period of channel development, and to provide for the disposal of this water in connection with the hill drainage.

(e) To provide for the relief of the basins from accumulation of rain and seepage water by means of pumps wherever gravity drainage is not practicable.

The cost of this work is estimated at $23,766,022, made up as follows: Levee construction, $6,833,650; channel development, $7,269,730; west side canal, $3,155,130; drainage of basins, $671,040; easement weirs, $735,400; intercepting canals, $230,400; bridges, $500,000; land damages (right of way), $1,250,000; telephone line, $29,452; total, $20,674,800. Adding for administration and contingencies 15 per cent., $3,101,220; grand total, $23,766,022.

The burden of this great work will be divided between the Federal and State governments and the land owners. I set forth the reasons why each will bear a part in the great work we are undertaking, as these reasons are pertinent to the general plan.

As is the case with all navigable rivers the navigation of the Sacramento and San Joaquin Rivers is a matter purely within the jurisdiction of the Federal Government, and its protection is a burden that the Federal Government has in all cases assumed. At an early period the Sacramento River was susceptible of navigation throughout its entire course in the Sacramento valley, and the Feather River was navigated as far as Marysville. From various causes the channels of these rivers have been obstructed and filled with sediment.

Both the navigability and the flood-carrying capacity of the rivers have been seriously impaired. This condition has arisen from the failure of the State and Federal governments to protect and maintain the channel; and in justice to the State of California the Federal Government should contribute to the joint fund it is hoped to create, the object of which will be not only to restore the channels to the condition they were in before impairment, but to add to their capacity to such an extent as shall justify reclamation of the lands through which they flow. To do this and maintain them in future, it will be necessary to prevent the escape of water from the river and to concentrate the flow within the channels in order to provide sufficient current to remove the sediment which has already accumulated and to prevent deposit in the future. There is an additional burden which should be borne by the Federal Government, and that is the correction and improvement of the channels so as to make them more serviceable for navigation. Commerce is rapidly increasing, and the valleys are becoming more productive, and this calls for provisions for moving the product.

The State is interested in the work for many reasons. The lands already partially reclaimed within the valleys will be saved from recurrence of the disastrous floods that have heretofore periodically devastated them. A large area of land that is now useless and unoccupied will be placed in a condition to make its reclamation possible, will afford homes for increasing population, and add to the products of the State to an enormous extent. It is estimated that a million acres of the richest land in California can be safely and permanently reclaimed and an average of fifty dollars an acre added to its value. The reclamation of some of this land has already been attempted; but part of it has been allowed to lapse entirely, and more of it is subject to occasional overflow, and an insignificant proportion only can be looked upon as being permanently reclaimed.

It is not reasonable to expect that the engineering plans of any great work can stand out entirely separate and distinct from the interests from which the plans are made. For this reason in this article I have dealt at length upon the various interests which will be benefitted by the great work as explanatory of the manner of the plan under which the work will be undertaken. The reclamation of Zuyder Zee in Holland will reclaim 478,720 acres of land at a cost of $101,000,000. It will take a generation to do this work. The work in California will reclaim more than twice as much land as the Zuyder Zee at less than one-fourth the cost for the entire work. The lands in this portion of California are as rich as any in the world and they are capable of cultivation the entire year round, while in Holland it is impossible during part of the year on account of the long cold winter.

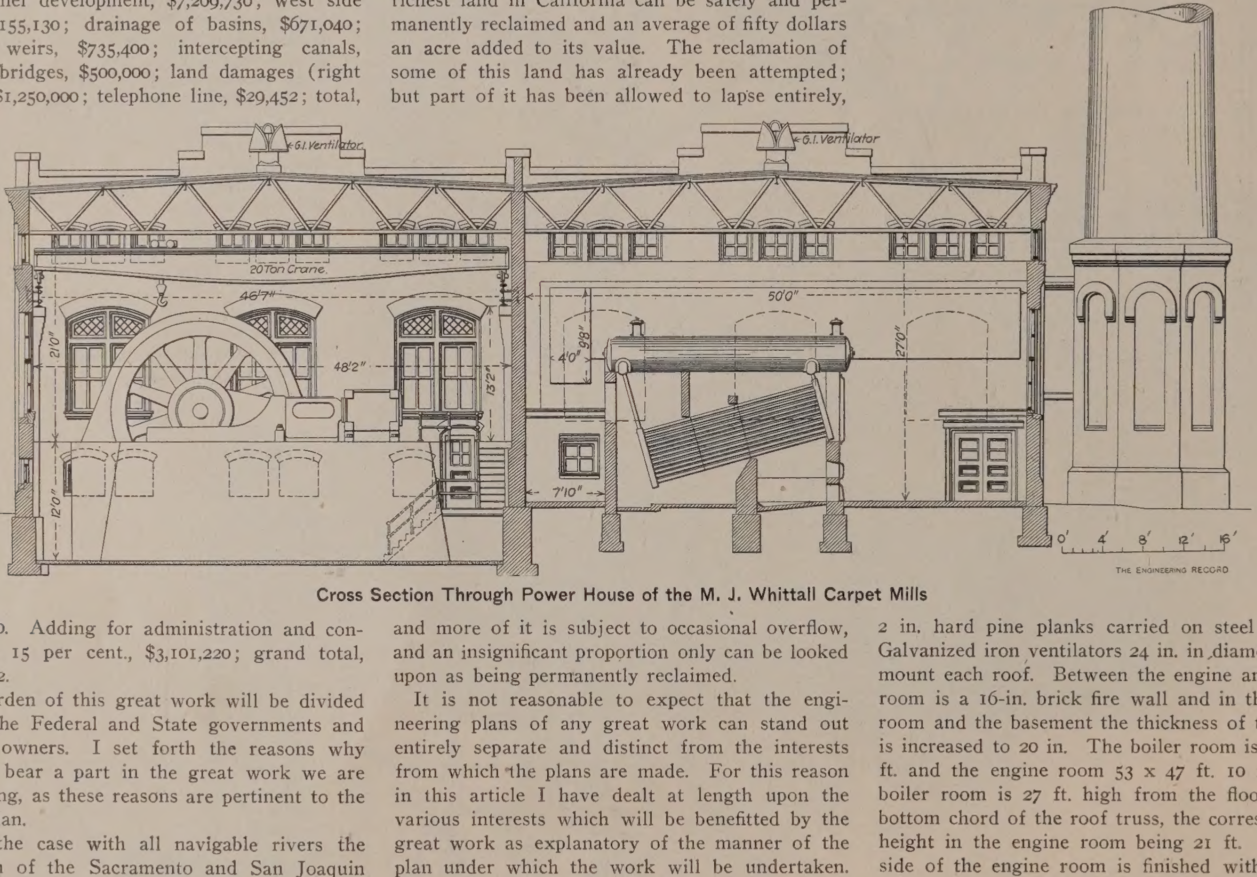
Damage to Asphalt Pavements by the vibration of the rails in street railway tracks has been much lessened in Cambridge, Mass., according to the annual report of Mr. George M. Clukas, superintendent of streets, by laying heavy 11-in. paving blocks in concrete on each side of the tracks.

The Power Installation at the Whittall Mills.

By Howard S. Knowlton.

An interesting new power plant and electrical installation has recently been placed in operation at the M. J. Whittall carpet mills in Worcester, Mass. It was designed by Messrs. Sheaff & Jaastad, of Boston, and replaces the old system of shaft driving from steam engines by a three-phase induction motor outfit; supplies current for lighting the mills and driving ventilating fans, steam heat for the various buildings and power for a new dye-house of special design.

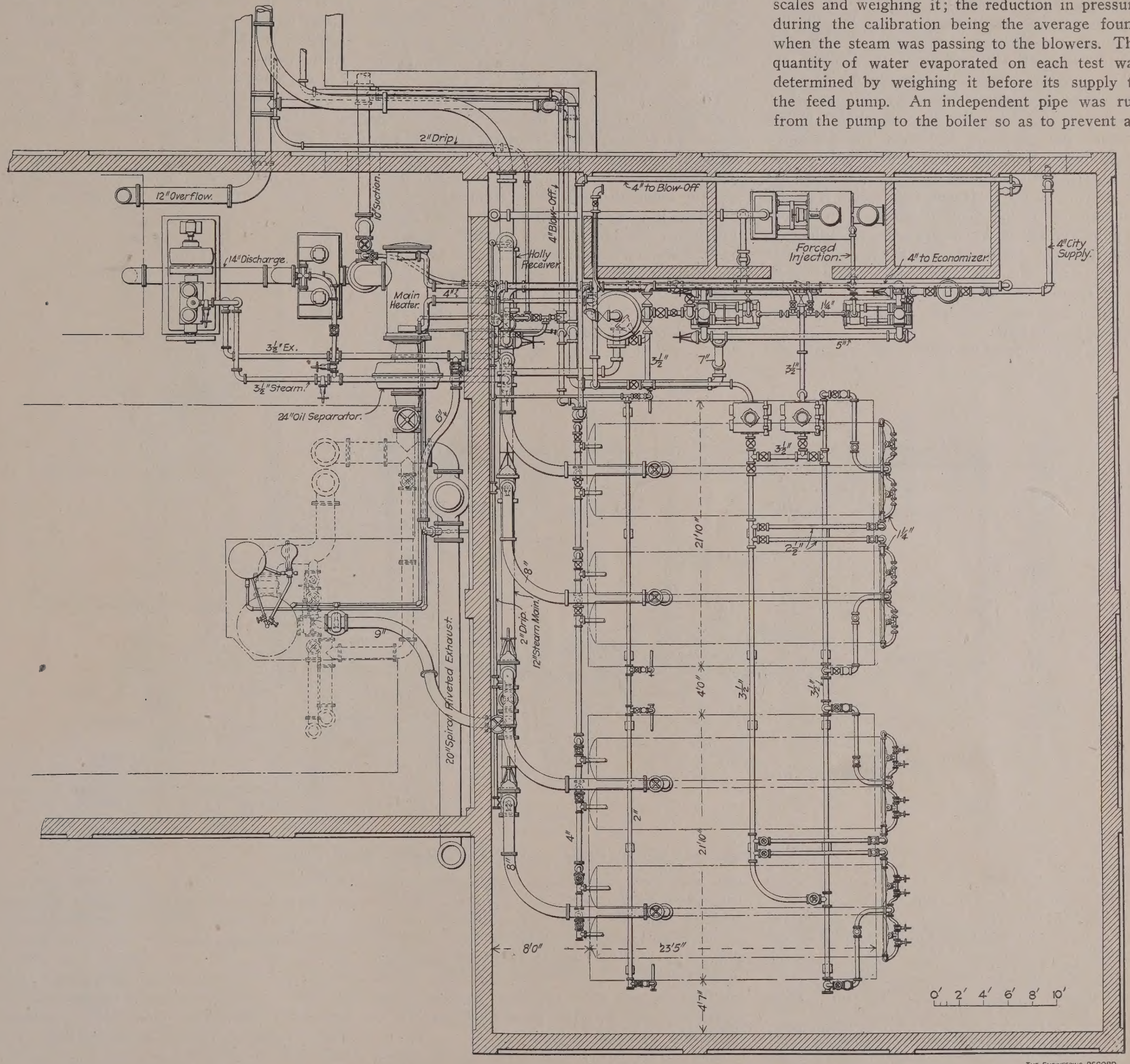
The power plant is a one-story and basement brick structure 102 ft. 10 in. ling, 74 ft. 4 in. wide and 31 ft. 8 in. high. Its walls are of brick 16 in. thick on concrete footings. The street floor is divided into two general sections; one of these contains the boilers, feed pumps, economizer, smoke flues, toilet room, fire pump and oil rooms, and the other is given up to the generating apparatus, switchboard and exciters. Below the engine room is a basement 12 ft. high, with a concrete floor, containing the condensing apparatus, hot well, a special pump, heater and oiling system tanks. Both the boiler and engine room roofs are of tar and gravel construction, the surface being laid on 2 in. hard pine planks carried on steel trusses. Galvanized iron ventilators 24 in. in diameter surmount each roof. Between the engine and boiler room is a 16-in. brick fire wall and in the boiler room and the basement the thickness of this wall is increased to 20 in. The boiler room is 71 x 50 ft. and the engine room 53 x 47 ft. 10 in. The boiler room is 27 ft. high from the floor to the bottom chord of the roof truss, the corresponding height in the engine room being 21 ft. The inside of the engine room is finished with cream-colored pressed brick with a dado of dark brown vitrified brick. Sixteen windows supply the daylight illumination of the engine room and the light brick walls in conjunction with these furnish an exceptionally even and bright light in every part of the room. Eight windows also supply the boiler room with light. Incandescent lamps and gas jets are provided in both rooms for night illumination. The general contractors for the power house and also the dye house were Messrs. J. M. & C. J. Buckley, of Worcester, and the steel work was supplied by the Eastern Bridge & Structural Co. Adjoining the boiler room is a Custodis brick stack 6 ft. 8 in. inside diameter and 150 ft. high.



Cross Section Through Power House of the M. J. Whittall Carpet Mills

The boiler room of the power house contains four 350-h.p. Babcock & Wilcox water-tube boilers set in batteries of two each. Each boiler has

168 tubes 4 in. in diameter by 18 ft. long, with two 42-in. steam drums 23 ft 3⅝ in. long. The tubes are set 14 rows wide and 12 high with continuous headers. The drums of each boiler are made of ½-in. open-hearth forged steel of 5,600 lbs. tensile strength. Each boiler has about 59.5 sq. ft. of grate surface, the grates being 8 ft. 6 in. wide by 7 ft. long. The boilers are built to stand 200 lbs. working pressure and are equipped with brass feed, drip and blow-off piping. They are set with white enamel brick fronts. Each battery occupies a space 23 ft. 5 in. long and 21 ft. 10 in. wide. A 4-ft. passageway is left between each battery and a 4-ft. 7-in. passage between the boilers and the north wall.

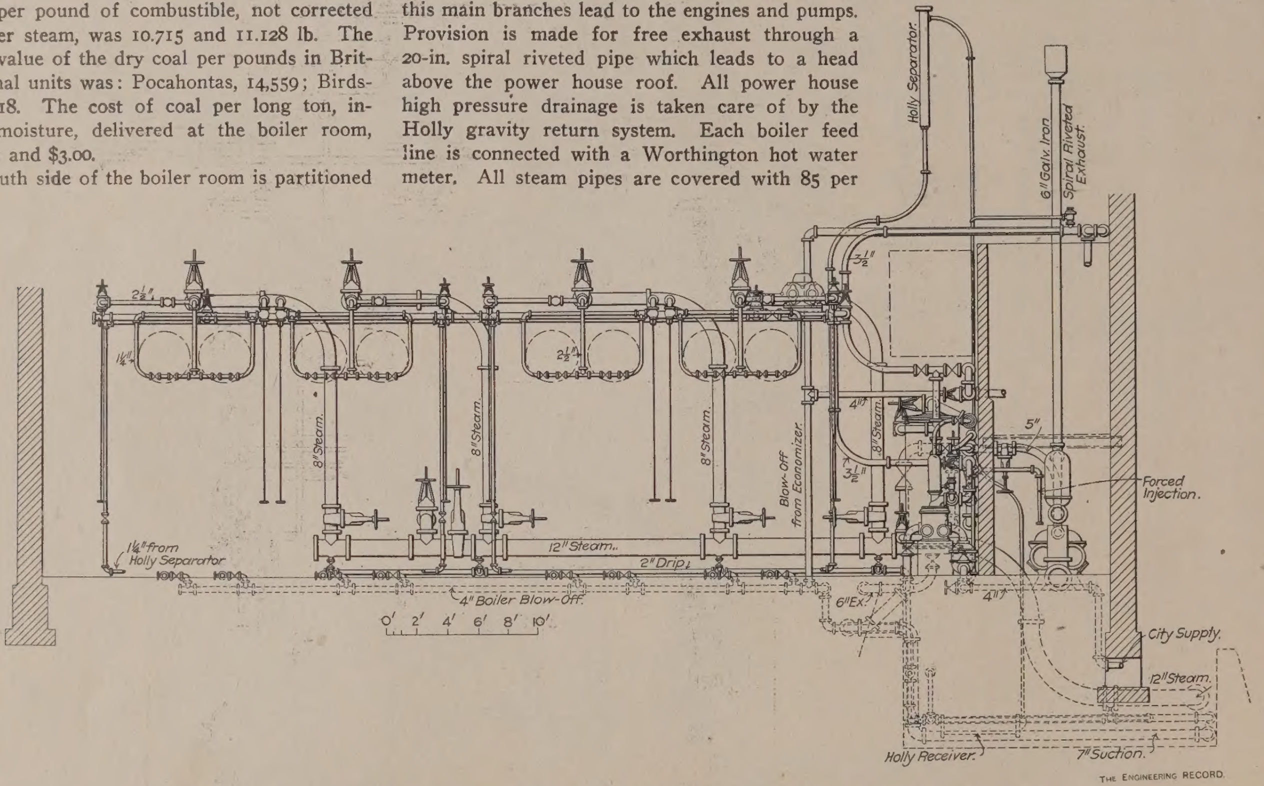


Boiler-Room and Part Engine-Room Basement Plan of the Whittall Power Plant.

All the boilers are to be equipped eventually with McClave grates and blowers, furnished by James Beggs & Co., of New York. One of the boilers in the battery nearest the north wall is now equipped with the McClave apparatus and the other ordinary furnaces and grates. The McClave grates have air spaces 3/16 and ¼ in. wide, and the surrounding metal is from ⅜ to ½ in. wide. There are two blowers, each containing eighteen 5/64 in. holes for the discharge of the steam jets. The plain grates have ⅝ in. air spaces with ⅞ in. metal. The grate surface in the boilers with the McClave grate is 61 sq. ft. Recently tests of these boilers were made by Mr. George H. Barrus, of Boston, to determine whether or not the McClave apparatus fulfilled principal guarantee of its makers in the Whittall plant, viz.: That by the use of 12½ tons of Birdseye coal of good average quality, the boiler would evaporate as much water with the McClave grate as it would with plain grates, natural draft and 10 tons of good average quality bituminous coal; making a saving of about 13 per cent. on the cost of running the plant with bituminous at $4.25 and Birdseye at $2.95 per ton delivered at the boiler room. The tests were made along the lines recommended by the American Society of Mechanical Engineers, the method of starting and stopping being the "alternate" method, the fire being cleaned just before the beginning and again just before the end of each test. The contractors for the grates furnished a skilled fireman for the test with Birdseye coal, and the Babcock & Wilcox Co. furnished an expert fireman for the bituminous test, which was made with Pocahontas coal.

In order to determine the quantity of steam used by the McClave blowers, the supply pipe above the regulating valves was provided with an orifice through which the steam passed, and gauge-pipes were placed above and below the orifice, to determine the reduction in pressure which the steam sustained in passing through the contracted opening. The size of this orifice was 7/16 in. in diameter. The apparatus was calibrated by shutting off the two blowers, drawing the steam off into a tub of water resting on scales and weighing it; the reduction in pressure during the calibration being the average found when the steam was passing to the blowers. The quantity of water evaporated on each test was determined by weighing it before its supply to the feed pump. An independent pipe was run from the pump to the boiler so as to prevent all possibility of leakage. Assurance was had that all the water which left the weighing apparatus was pumped into the boiler under test, and that none escaped through leaking valves. The tests showed that with 11.25 tons of dry Birdseye coal burned with the McClave system, as much evaporation was produced as with 10 tons of dry Pocahontas coal burned with plain grates. The Pocahontas coal used showed 1.9 per cent. moisture against 7.2 per cent. in the Birdseye, and 9.2 per cent. of ash and refuse in dry coal against

18 per cent. in the cheaper grade. The McClave blower used 5 per cent. of the total steam. The dry coal burned per square foot of grate surface per hour was 18.6 lbs. with the plain grate boiler, and 20.5 lbs. with the McClave. The equivalent evaporation per hour from and at 212° Fah. per square foot of heating surface was 3.1 lbs. plain grate and 3.3 lbs. McClave grate. The boiler pressure averaged 114.4 and 122; the temperature of the escaping gases from the boilers 533.8 and 453.1 degrees Fah.; and the force of the draft between the damper and the boilers 0.35 and 0.27 in. respectively, with the plain and McClave grates. The force of the draft in the ash pit under the McClave grate was 0.53 in.; the percentage of moisture in the steam was 0.29 in each case, and the feed-water temperature 55°. The equivalent evaporation from and at 212° per pound of dry coal as fired, corrected for blower steam was 9.548 and 8.03 lb., respectively, for the plain grate and the McClave; the equivalent evaporation from and at 212° per pound of dry coal, corrected for blower steam, was 9.732 and 8.653 lb., and the equivalent evaporation from and at 212° per pound of combustible, not corrected for blower steam, was 10.715 and 11.128 lb. The calorific value of the dry coal per pounds in British thermal units was: Pocahontas, 14,559; Birdseye, 12,318. The cost of coal per long ton, including moisture, delivered at the boiler room, was $4.45 and $3.00.



Elevation of Steam and Auxiliary Piping, Showing Arrangement of Steam Header.

The south side of the boiler room is partitioned off into an oil room 8 ft. x 7 ft. 9 in., a pump room 14 ft. x 7 ft. 9 in., and a toilet room 9 ft. 6 in x 7 ft. 9 in. The floor is of concrete and the oil room is provided with a fire door of iron construction 7 ft. high, 3 ft. 6 in. wide and 2¼ in. thick. The partition walls are of brick, varying in thickness from 8 to 12 in. The toilet room has a shower bath for the use of employes.

A smoke breeching of sheet iron 9 ft. 8 in. x 4 ft. in section leads from the boilers to a Green economizer containing 520 tubes built in sections 10 ft. wide and supported above the boilers. The economizer scrapers are run by a 2 h.p. induction motor. The economizer occupies a space 32 ft. 7½ in. long, 8 ft. 1 in. wide and 9 ft. 8 in. high, and is connected with the power house chimney by a brick flue 10 ft. 6 in. high and 3 ft. 6 in. wide. A sheet iron by-pass is also provided so that the economizer can be cut out of service whenever desired. Feed water passes into the economizer through a 4-in. cast iron pipe. A Locke damper regulator is also installed.

The 8 x 5 x 12-in. boiler feed pumps are two in number of the Geo. F. Blake Mfg. Co. horizontal duplex type mounted on brick foundations. The pumps are set up in a passageway 10 ft. wide between the boilers and the partitioned section of the boiler room. In the pump room is a 20 x 12 x 16-in. Blake Underwriters' fire pump having a capacity of six good 1⅛-in. smooth-nozzle streams. There are two exhaust steam feed water heaters in the plant in addition to the economizer. Both are American closed heaters supplied by the Whitlock Coil Pipe Co., of Hartford, Conn. The main heater is rated at 800 h.p. and is installed in the exhaust piping between the low pressure cylinder of the engine and the condenser. The auxiliary heater is rated at 1,000 h.p. and is installed in the boiler room. It utilizes the exhaust steam of the pumps. The main heater is 98 in. long and 48 in. in diameter. The auxiliary heater is 130 in. high and 48 in. over-all diameter.

The Carman-Thompson Co., of Lewiston, Me., were the contractors for the steam piping of the plant. In general, the main steam piping is 8-in. wrought iron pipes leading from every pair of boilers into a 12-in. steam main which runs horizontally along the rear boiler room wall. From this main branches lead to the engines and pumps. Provision is made for free exhaust through a 20-in. spiral riveted pipe which leads to a head above the power house roof. All power house high pressure drainage is taken care of by the Holly gravity return system. Each boiler feed line is connected with a Worthington hot water meter. All steam pipes are covered with 85 per cent. carbonate of magnesia, a 50 per cent. grade being used on the smoke flue. The dye house is supplied with hot water from a hot-well in the power house basement through a 7-in. cast iron pipe. This water is pumped over by a centrifugal pump belt-driven by a 20-h.p. induction motor. All the valves are of the standard Chapman bronze gate type, except throttle valves, which are Crosby globe type with spring seats.

Between the power house and the dye house, and from thence to the Worcester carpet mills of the Whittall establishment, there is a concrete pipe and wire tunnel 6 ft. wide and 5 ft. high.

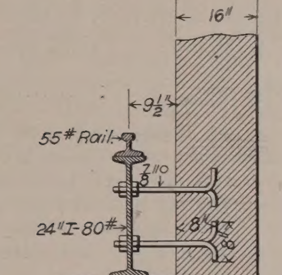
The engine room of the plant is served by a Whiting hand power traveling crane with a lifting capacity of 40,000 lbs. But one generating unit is installed, with the exception of a steam driven exciter. This unit consists of an 800 k.w., three-phase, 600 volt, 40 cycle Westinghouse revolving field alternator direct-connected to a 26-in. x 54 in. x 48 in. Filer & Stowell horizontal cross-compound engine built for 150 lbs. working steam pressure. The normal speed is 92 r.p.m. The low pressure cylinder is built for a working pressure of 60 lbs. gauge and Keasbey & Mattison's magnesia, 85 per cent. pure, is used on the cylinder walls. Steam enters the cylinders from underneath the floor. Throttle valves, each equipped with a by-pass, are provided on the high and low pressure sides of the engine. A 9-in. wrought iron steam supply pipe is connected between the high pressure cylinder and the boiler room main. A vertical reheating receiver is installed in the engine room basement between the cylinders. A safety stop is provided with the engine and the governor is designed to control the point of cut-off from 0 to ¾ stroke. The valve gear of the low pressure cylinder is operative either by governor or fixed cut-off at will. The flywheel is 18 ft. in diameter and can run 102 r.p.m. with a factor of safety of 8. It weighs approximately 100,000 lbs., and is carried on a 23-in. wrought iron shaft which runs in 19 in. x 40 in. bearings. The approximate total weight of the engine is 375,000 lbs.

The exciters are two in number, one being used for starting and the other for regular operation. The former consists of a 30 k.w., 125 volt Westinghouse generator direct-connected to a 9½ x 9-in. duplex vertical single acting engine of the same make. Steam is supplied through a 3½ in. pipe and there are two 43 in. flywheels for the set. The other exciter is a generator similar to the above, driven by a direct coupled 45 h.p., three-phase Westinghouse, 550 volt induction motor. Near the motor is mounted an auto-starter carried on a wooden frame held by iron legs fastened to the floor.

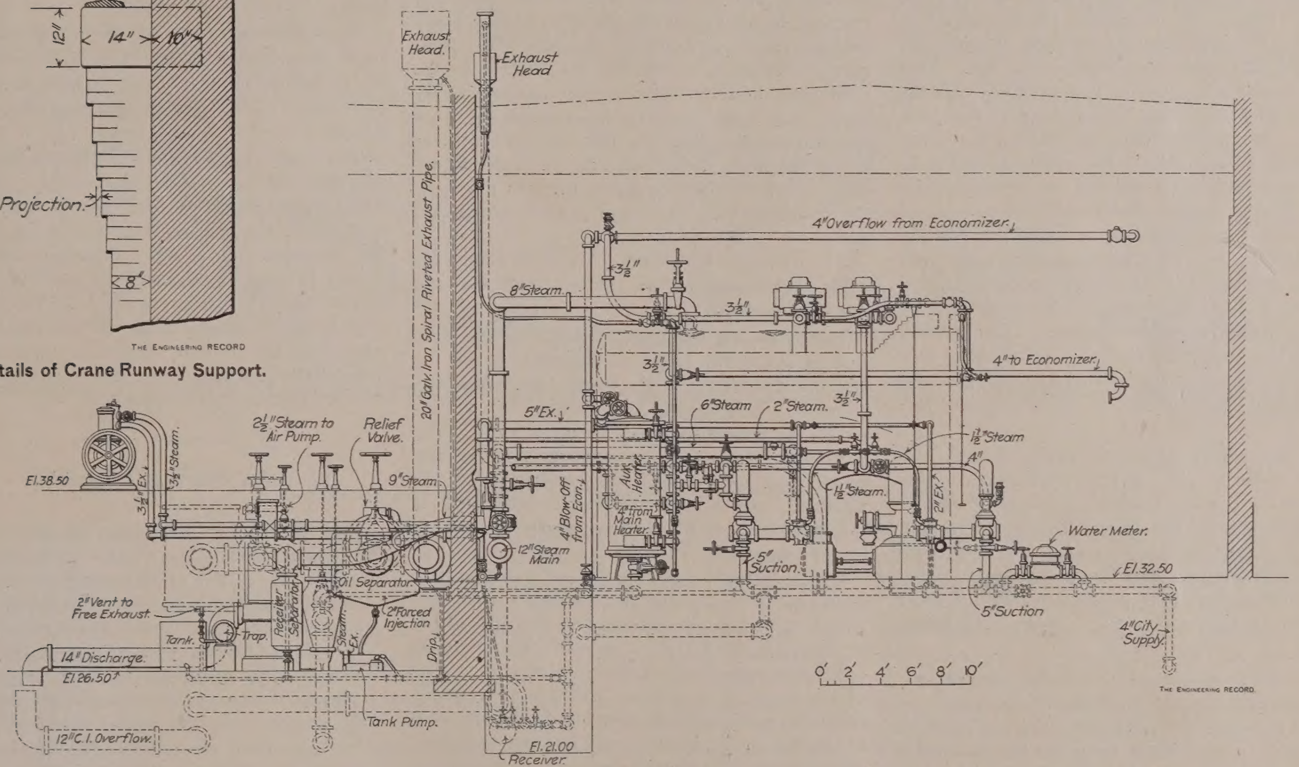
The switchboard is mounted on angle irons 5 ft. 6 in. away from the east wall of the engine room. It is illuminated in the daytime by four windows which give an exceptionally bright lighting of the rear. There are five marble black enamelled panels in the board, viz: one 24-in. exciter panel, one 40-in. generator panel, two 24-in. power panels and one 24-in. lighting panels. Each panel is 90 in. high and the arrangement of instruments and switches appears to be standard. Polyphase wattmeters are used on the power panels and single-phase wattmeters on the lighting panel. The generator panel is equipped with a 1,200-kw. indicating wattmeter in addition to the usual apparatus. The switchboard and its equipment are also of Westinghouse make.

The main resistance for the alternator field is supported on a cast-iron platform hung from the basement ceiling beneath the switchboard. Tin sheeting is installed above this for protection of the engine room floor against overheating. The basement also contains an oiling system designed and installed by the Carman-Thompson Co., and a 14-in. by 32-in. by 21 in. vertical twin jet air jump and condenser made by the Geo. F. Blake Mfg. Co.

Concrete foundations were built beneath the steam driven exciter, extending to the basement floor line. The travelling crane has a span of 46 ft. 7 in. and its rails weigh 55 lbs. per yard. They are supported on 24-in. steel I beams set on stone-capped pilasters 14x12-in. in sectional dimensions. The main engine foundation is 39 ft. 4 in. by 29 ft. 9 in. A 24-in. Cochrane vacuum oil separator is installed between the low pressure cylinder and the condenser. It was made by the Harrison Safety Boiler Works.



Details of Crane Runway Support.



Part Cross Section of the Plant, Showing Steam and Auxiliary Piping Systems and Arrangement of Auxiliary Apparatus.

The electrical equipment constitutes one of the most interesting portions of the plant. Throughout the mills are distributed about 25 motors of the Westinghouse type C induction form, varying in size from 2 to 75 h.p., making a total full load rating of about 800 h.p. in motors. There are installed about 2,000 incandescent lamps and about 15 alternating current arc lamps in the weaving rooms. About 1,000 of the reflector type of incandescent lamps are installed, which are 32 c.p. frosted bulb of Sawyer-Man make. About 8 tons of wire were used in the installation. Practically all of this wire is white, slow burning, weatherproof wire. A considerable amount of 500,000 cm. cable was used and a large part of this was installed under very difficult conditions, as there were long runs of cable leading from the switchboard through tunnels, up walls, along ceilings, in low studded basements, through shafting, belts, etc. Three of the large cables were enclosed in iron pipe, each cable being enclosed in circular loom conduit. Rubber-covered wires were used in the dye house.

For the lighting circuits three transformers were installed, one 50-kw and two 30-kw. These were placed in vaults in the ground outside the buildings. The secondary voltage is 110 and the primary voltage 600. All the lighting switches are enclosed in fireproof boxes so arranged that they can be handled from the outside.

The motor controllers are all the new Westinghouse oil-immersed auto-starters. Noark fuses were used throughout the installation, and in the dye house the cutouts were enclosed in Noark moisture-proof boxes. The rather unusual voltage of the motors for factory practice—600—is noteworthy.

The geography of the plant divides the motors naturally into three groups, each group being on a separate set of mains. These groups, their average distance of feeding and their supplying cables are:

HP.	Average distance ft.	Cables.	C.M.
470	500	3	500,000
170	600	3	300,000
160	400	3	No. 0000 B. & S.

The contractors for the electrical work were the Page Electric Co., of Worcester, Mass.

A NOVEL PUMPING PLANT is under construction for the Casino, N. S. W., water-works. The supply will be drawn from the Richmond river by a four-stage centrifugal pump in a shaft 10 ft. in diameter and 55 ft. deep. This pump will be driven by a horizontal tandem compound engine at the ground level, and is rated at 9,700 gal. per hour against a total head of 178 ft. The water will be forced into a 480,000-gal. concrete service reservoir.

Sewer Tunneling with a Shield in Cleveland.

The sewer work in Cleveland has been remarkable for many interesting features which have been described in this journal, and at the present time presents another unusual condition. At one place a main sewer lies for about a mile along one side of the right-of-way of the Lake Shore & Michigan Southern Ry. Co., and the privilege to build the sewer here was only obtained by agreeing to comply with many conditions making the work expensive. An interesting account of the undertaking was contributed by Mr. J. M. Estep to the last number of "The Polytechnic," the students journal of the Rensselaer Polytechnic Institute, from which the following notes have been taken:

After the construction of the sewer had been begun the railway company insisted that 9-in. Wakefield sheet piling be used instead of the 2 and 3-in. sheeting specified in the contract for the work. As a result of this action on the part of the railway company the cost of the work was increased about $21.00 per linear foot.

The top width of the trench was about 20 ft. and the average depth about 40 ft. The upper set of sheet piling was 28 ft. long. The excavation consisted of dry sand, wet sand, quicksand and clay and sand mixed. The sheet piling was well driven, but in passing a one-story brick building used as a machine shop, enough of the quicksand found its way through and under the sheeting to cause a settlement in the foundation of the building, and, in consequence, large cracks developed in the brick walls, opening up several inches in width at different points. A few hundred feet east of this place is a large three-story brick building used for manufacturing purposes, located within a few feet of the line of the trench, and it was feared that the safety of the building would be endangered by constructing the sewer in open cut, and after due consideration it was decided to build the remainder of the contract, about 1,100 ft., in tunnel. This plan was finally adopted. The work progressed nicely, more rapidly than open cut work, and the construction was so thorough that not the slightest settlement occurred in passing the factory, and no settlement occurred anywhere in the tracks of the railway company; but, where the sewer was constructed in open cut, bills to the amount of hundreds of dollars were paid to the railway company for repairs made to their tracks on account of settlement caused by the sewer.

Owing to the many evident advantages of tunnel construction over open cut work it was decided to build the section adjoining the one above referred to in tunnel by the same method and of the same construction. In the fall of 1904 the railway company built two additional tracks, one on each side of its two main tracks, so that one of the tracks came within a couple of feet of the line of the sewer trench, and it would have been impossible to have done the work in open cut without violating the State law, which does not allow any obstruction to be placed within 6 ft. of the tracks.

The cost of the open cut work on this section amounted to $71 per linear foot, and it was thought just and proper to allow the contractor to do the work in tunnel at the price that would have been paid had it been done in open cut, as the work could be performed much more rapidly and the construction equal to that originally planned. The original contract did not provide for the use of the Wakefield sheet piling, but, knowing it would have to be used in open cut, the cost, $71, per foot included its use. This would make the cost of the work exceed the appropriation by about $18,000, and it was held by the City Solicitor that the contract could not be changed to tunnel work unless it could be performed within the amount of the appropriation. The contractor finally decided to proceed with the work for $98,250, or practically $60 per foot, a reduction of $11 per foot. The sewer now under construction is 13 ft. 6 in. in diameter, and is being built of four rings of No. 1 shale brick laid in Portland cement mortar. From a point 2 ft. below the spring line to a point about 4 ft. from the crown of the arch the masonry is laid in Flemish bond, keyed in with rowlock masonry.

The contractor's plant is equipped with two 60-h.p. boilers, one 20-h.p. high-speed engine operating a dynamo having a capacity of 250 incandescent lights; one Ingersoll-Sergeant straight line air compressor; one feed pump; one high pressure hydraulic pump for operating the jacks; one hoisting engine for shaft elevator, and other necessary meters and tools to make a first-class plant.

The work is carried on under air pressure. The lock consists of a section of the sewer included between two brick bulkheads 24 in. thick and 24 ft. apart. Each bulkhead has a wooden door made of 4-in. tongued and grooved lumber. When closed, the doors press against rubber gaskets to prevent leakage. The lock is of cheap construction and differs considerably from the usual style of lock for such purposes, but the results are quite good. It is supplied with large valves so that the lock can be filled or emptied in one minute or less. Ordinarily a pressure of about 5 lb. is maintained, which is sufficient to keep the tunnel dry and to give a good supply of fresh air to the workmen. When soft spots occur in the excavation the pressure is run up to about nine pounds; a greater pressure than this would probably "blow out" through the roof, as the hard material in the roof is not thick enough to stand a greater pressure. The excavation is principally a hard, dry quicksand, at times mixed with clay, which makes a good covering to hold the small pressure usually carried. A hydraulic shield is used, by means of which the excavation is carried on rapidly, is of the exact diameter required and smooth finish, and dispenses entirely with the use of timber for protection.

Three-quarter-inch steel is used in the construction of the shield, the total weight of which is about 16 tons. It is 4 ft. long and 16½ ft. in diameter. The upper half is provided with a "follower" 7 ft. long, made of ¾-in. steel, bolted to the shield. The "follower" prevents the roof from falling and is a protection to the workmen. When the roof is of hard material the "follower" is pulled off of the brickwork about 2½ ft.

The shield is equipped with twelve hydraulic jacks, 5 in. in diameter and 26 in. long. The water is conveyed to the jacks by a pipe line containing a swinging joint in the shape of an inverted "V" with the joint at the apex, which allows the shield to be shoved ahead and to pull the pipe with it. The pump supplying the water to the jacks can be operated to a pressure of 6,000 lb., but the average pressure used in shoving the shield is about 700 lb.

The miners excavate ahead of the shield about 2 ft. The signal is given and the hydraulic pump in the engine room is set to work, and the pressure applied to the jacks shoves the shield ahead into the part previously excavated. At the beginning of each day's work the heads of the jacks stand about 1 ft. from the brickwork. Large wooden blocks are placed against the two outer rings of the brickwork and the other blocks placed between these and heads of the jacks. The pressure is transmitted through the blocks to the brickwork, and the latter is not injured in the least. Any bricks that may be loosened are taken out and relaid. After the first shove of 2 ft. or 26 in., the limit of the jacks, the jacks are forced back and more blocking placed between them and the other blocks. The same process is repeated each time a shove is made.

All material is handled in cars of about one cubic yard capacity. The cars are pushed in and out by laborers.

The tunnel is being constructed within three feet of the north track of the railway, and no settlement whatever in the tracks has so far been apparent. This method of tunneling has demonstrated its superiority over open cut work. The work can be carried on continuously day and night, and at all seasons, regardless of the weather. The mortar is mixed in the tunnel at the face of the work, and can easily be watched by the inspectors. It requires fewer laborers, and much more rapid progress can be made than in open cut. The average rate of progress in open cut on the same size of sewer at the same depth is from 125 to 150 ft. a month. The tunnel at present is being built at the rate of 9 ft. a day, or about 250 ft. a month. Ten feet a day could easily be made, but the contractor does not want to take too great chances by pulling the "follower" off the brickwork any farther than he is doing at present. Two masons lay up the 9 ft. a day in about eight hours, and any amount over that would necessitate an extra mason. Each mason has to lay about 5,000 bricks a day, which constitutes a good day's work. There are 8 cu. yd. of excavation in each linear foot of sewer and 2.62 cu. yd. of masonry, or about 1,100 bricks per linear foot.

In the following tables the gangs have been arranged according to shifts, giving the number of men to each shift and the wages paid. The superintendents are the contractor's sons, and their wages have been estimated at $5 per day. The other wages have been learned from the men themselves. In some cases the wages are rather low, but the laborers are mostly Polaks.

First Tunnel Gang, 11 p. m. to 7 a. m.		
1 head miner at $4.00	$4.00	
3 miners at $3.50	10.50	
2 muckers at $2.50	5.00	
1 double team at $5.00	5.00	
		$24.50
Second Tunnel Gang, 7 a. m. to 3 p. m.		
Same number as first gang		$24.50
Total for tunnel gangs		$49.00
Brick Shift, 3 p. m. to 10 p. m.		
2 bricklayers at $8.00	$16.00	
4 tenders at $1.75	7.00	
2 car pushers at $1.75	3.50	
		$26.50
Top Gang, 7 a. m. to 5.30 p. m.		
4 laborers at $1.50	$6.00	$6.00
Day Shift, 7 a. m. to 7 p. m.		
1 superintendent at $5.00	$5.00	
1 engineer at $3.25	3.25	
1 fireman at $1.75	1.75	
1 carpenter at $2.00	2.00	
4 car pushers at $1.75	7.00	
1 car dumper at $1.75	1.75	
		$20.75
Night Shift, 7 p. m. to 7 a. m.		
1 superintendent at $5.00	$5.00	
1 engineer at $3.25	3.25	
1 fireman at $1.75	1.75	
4 car pushers at $1.75	7.00	
1 car dumper at $1.75	1.75	
		$18.75
Total labor for 24 hours		$121.00

At the present rate of progress of nine feet a day, the cost of labor per foot of tunnel is $13.45. The estimated cost of the plant, including the shield and jacks, is $13,000, or about $8 per linear foot of tunnel. The fittings include rails, pipe, wire, lamps, floor timbers, coal and other supplies.

The estimated cost of the work per linear foot, on a basis of 9 ft. a day, may then be summed up as follows: Labor, $13.45; plant, $8; fittings, $4.50; brick, $9.90; cement and sand, $3.70; total, $39.55.

The daily labor item of $121 is the same, whether 9 ft. or less are made a day. Bad material would check the progress to 6 ft. or less a day, and the cost per foot would consequently be increased. It is quite probable that higher wages in some cases may have to be paid as the season for other work opens up. The cost per foot as given above is only for the tunnel work, and does not include shafts or manholes, but these items ought not add more than one dollar a foot to the cost as given above.

An Important Report.

One of the most important reports issued by the Government is the "Tests of Metals," published by the Chief of Ordnance, U. S. A., and giving the complete data of all tests of metals and other materials made at the Watertown Arsenal. The volume for the year ending June 30, 1903, which has just appeared, is a book of 556 pages, profusely illustrated, containing data relating to tests of steel, including nickel steel, old iron and steel bars which were first tested years ago, and cement and concrete. Among the last-mentioned samples were a number in which the concrete was forced to set under pressure within moulds, and developed compressive resistances far above those of similar material allowed to set in the usual way. The tests of nickel steel show conclusively that higher elastic limits and tensile strength, accompanied with toughness, result from the addition of nickel to steel. Experiments have been made, confirming results of earlier tests elsewhere, on the effect of torsional strains carried beyond the elastic limit of the metal, upon the subsequent tensile properties. Overstraining in a tensile direction, followed by a period of rest, causes an increase of the elastic limit and ultimate tensile strength. The torsional overstrain, although stretching some of the fibers, shortened the bar as a whole. This resulted in a decided increase in tensile strength; the greater the number of twists the higher the tensile strength of the specimen turned down from the twisted bar.

A High-Pressure Water System at Newark, N. J.

The part of the new high-pressure system in the Newark, N. J., water works which will furnish fire protection to the central portion of the business district is nearly completed. This district is now afforded fire protection by fire steamers drawing water from the regular distribution system of mains, the distribution system at present having a gravity supply brought 27 miles from three impounding reservoirs on the Pequannock River, but distributed from a local low service reservoir. The high-pressure system will be supplied from the Cedar Grove reservoir, which is 7 miles from the city, the construction of which was fully described in The Engineering Record Dec. 5, 1903.

The portion of the distribution system in the district covered by the high-pressure system is supplied from a small distributing reservoir in the city referred to above, which only produces a pressure of from 30 to 40 lb. at the hydrants in the business district. The high-pressure system will also have a gravity supply furnished from the Cedar Grove reservoir, its supply line being laid on a more direct route than the supply lines of the distribution system and the pressures in it will be much greater than in the latter. The difference in elevation between the new reservoir and the street level in the high-pressure district is about 375 ft. and the new system has been designed to be capable of furnishing at least eight 300-gal. per minute fire streams with a pressure of 125 lb. at the hydrants.

Regular 30-in. cast iron mains are used on the upper end of the supply line and are carried down until the pressure and grade both begin to increase rapidly, from which point to the center of the high-pressure districts, heavy 24-in. mains are laid, with heavy 20 and 12-in. mains branching from them. From the end of the 30-in. main all the pipe has special double-leaded joints to provide for the high pressure which will be continually maintained. The hub ends of the pipe sections with double lead rings are reinforced with wrought-iron bands in order that the joints may be caulked with unusual force.

The joints on the 20 and 24-in. sections are shown in an accompanying illustration where the relative spacing is so evident that it does not need further explanation. The pipes are cast in the usual manner and the wrought-iron bands are afterward shrunk on, avoiding unusual thickness at the ends of the pipe and the making of entirely new sets of patterns in the foundry. The shoulder of the hub is cast slightly thicker than is required and it is then turned down to a smooth finish, with a 1/32-in. level as shown, and the wrought-iron bands shrunk on, producing an unusually strong section. The pipe has all been cast and the bands put on it in the works of the Warren Foundry & Machine Co. The joints between the bands and pipe have been uniformly good and have permitted the heavy caulking necessary with the double joint without any apparent effect.

The double joint is double, not only in its construction, but also in the manner in which it is poured and caulked. Mr. Morris R. Sherrerd, engineer and superintendent of the water department of Newark, considered that nothing like the full value of the two lead rings could be obtained if the lead was all poured at one time, so he devised a special method of pouring and caulking the lead separately for each ring of the joint. The yarn is first placed at the inner edge of the joint in the usual manner and a special runner, which fits closely the annular space between the hub and the spigot, is then pushed into this space until it is in position in front of the inner lead ring. The lead for this part of the joint is then poured, the runner removed and the joint caulked with considerable force. The usual form of runner is then set in the same position it would occupy if the joint were a single joint on a regular pipe. This outside runner has a slight bevel cut from it along its lower and inner edge so when the lead is poured a small ring or lip of lead is left outside of the hub. This excess lead is loosened slightly from the pipe all around and then the joint is caulked until all of the excess lead is included in it, leaving it flush with the shoulder of the pipe.

The high-pressure system although laid exclusively for fire protection will be connected to the distribution system and will supply a limited amount of water for domestic consumption. The connections with the distribution system will be made at the new city hall through automatic pressure regulators which are so designed that when the pressure in the distribution system falls below a certain amount the regulators will open and admit a supply from the high-pressure system. In this manner the normal pressure may be maintained in the distribution system during fires or at times of unusual draft without materially affecting the pressure in the high-pressure system. The distribution system is provided with a system of alarms which come into action in case of an unusually heavy draft on it, such as might be occasioned by a broken main, and the danger of a depletion of the supply in either system is thus avoided.

The water that is furnished from the high-pressure system for domestic purposes will be used chiefly for the upper floors in high buildings and for hydraulic elevators, but only a limited number of consumers will be so supplied with water, which will be sold at a 20 per cent. advance over the regular meter rates. Private connections for fire protection are also permitted to be made to the new system and will be charged at a certain fixed rate depending on the size of the connection. The pressure in the system being constantly maintained will permit the use of automatic fire sprinklers on these private connections.

The hydrants that have been installed thus far were furnished by the Rensselaer Mfg. Co. and have four 2½-in. hose nozzles and one steamer nozzle. The valve stems are operated with a wrench on the top in the usual way, but the end of the valve stem is surrounded by a socket so that none but special wrenches, which will be supplied only to the fire department, will fit them. Experiments are now being conducted to obtain a hydrant which will give positive indication when several nozzles are shut off or turned on, to avoid having the auxiliary valve stems broken by rough usage.

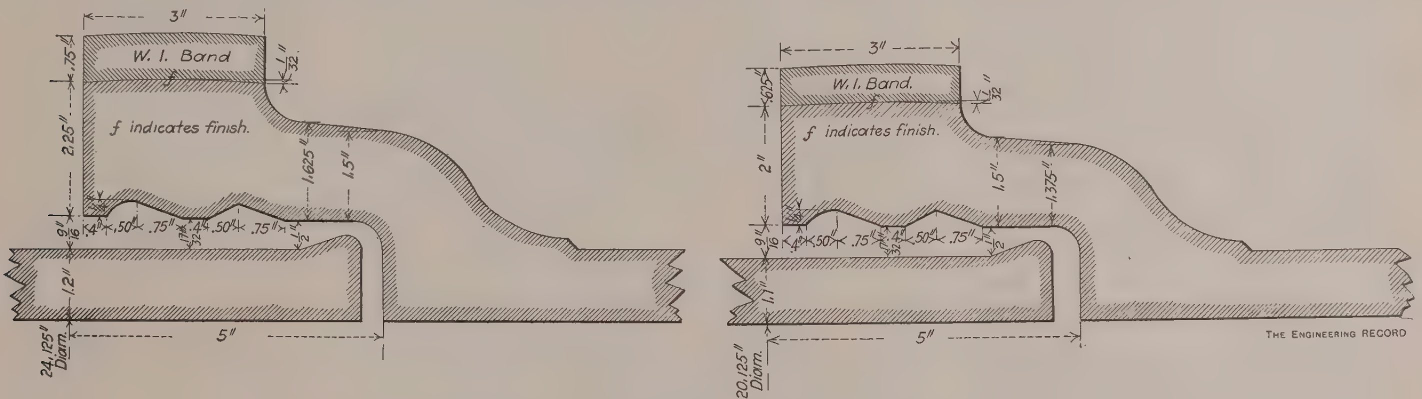
All the gates on the 20 and 24-in. mains have 6-in. by-passes to permit the mains to be filled quickly if the line has to be shut off or drained at any time. All the valves on branches larger than 8-in. have four lugs and others two lugs by which they are tied with iron rods to the mains. The hydrants are also connected to the mains in the same manner to avoid having the joints on the connecting pipe pulled apart by the heavy pressure.

At present about 3½ miles of mains have been laid, but these have been made large enough to provide for future extensions and branch connections are provided in various places. All extensions are to be made on the basis that the revenue received must be 10 per cent. of the cost of installation and the property benefited must advance the first cost, which will be rebated from the water charges.

Considerable difficulty has been experienced in laying the new mains owing to the presence of the mains of the distribution system, sewers, electrical conduits and other sub-surface structures.

In a portion of the business district the new mains were laid about 11 ft. below the street surface to avoid complications with the existing structures and the remainder of them are laid at least 6 ft. deep for the same reason. The mains pass under an old canal at one point and there they were laid 20 ft. below the surface and the joints all run solid and caulked from the inside as well as from the outside of the pipe.

The plans for the new system were prepared by the water department of Newark, Mr. Morris R. Sherrerd, engineer and superintendent, and it is being installed by day labor under direct supervision of Mr. George Sanzenbacher, asistant engineer and superintendent.



Details of Joints on the Cast Iron Mains in the Newark High-Pressure System.

The Deformation of a Brick Sewer Arch caused by the movement of the sides where the filling against them had yielded required the entire reconstruction last year of portions of a sewer in Cambridge, Mass. The sewer was built on a heavy wooden platform and is 8 ft. 4 in. high and 8 ft. wide, with a 12-in. brick arch. About 570 ft. of it were replaced by a reinforced concrete and brick structure, which in some cases was placed on the old platform footings. According to City Engineer L. M. Hastings, this form of construction was less expensive than the original.

Electricity in Textile Mills.

Naturally enough electricity occupied a large place on the programme of the recent convention of the New England Cotton Manufacturers' Association, for the advocates of the rope drive have of late been outspoken against the use of electricity in such factories and such a meeting offered an opportunity for presenting a reply. Mr. Meldon H. Merrill contributed a general discussion of the value of the motor drive in cotton mills, dwelling particularly on the induction motor and the steam-turbine generating unit. He advocated direct-connected motors for the machinery, and claimed for them an increase of 5 to 7 per cent. in production over a group drive with belting from a motor-driven shaft. He acknowledged that the first cost of such an installation will be large in comparison with a group drive, but claimed that it would not be in mills using the group drive. The shafting and belting have been carefully measured, from which the costs have been determined. These costs will, of course, be less than the cost of equipping a mechanically driven mill, as in the latter case the heavy main driving shafts would have to be included. The cost of the shafting, belting and motors has been compared with the cost of a requisite number of individual motors for the same machines. The difference shows the excess of the proposed investment (direct drive) over the present investment (group drive). Interest on this amount at 4 per cent. has been allowed; in all cases this interest charge has been balanced against the saving in horse-power at $25 per year per horse-power, due to the absence of shafting, the differences in motor efficiencies being taken into account. The results show the saving per year credited to the direct connected drive.

Take for example the spinning room in one of the large New England mills; in this mill a 200-h.p. motor operates 52 ring spinning frames. The cost of the installation is shown as follows:

Motor,	$2,060 00
Belts and shafting,	634 00
Total,	$2,694 00

With the direct-connected drive 52 3-h.p. motors would be required, at the cost of $5,290, leaving a difference in favor of the group drive. Interest on this amount at 5 per cent. would equal $128 per year. It was found from actual tests at the above mill, that 37½ h.p. was required to drive the shafting load, no frames being in operation. Taking into account the difference in motor efficiency, Mr. Merrill finds a saving of 18 h.p. by using the direct connected method. Eighteen h.p. at $25 per year amounts to $450, which compared with $128, the interest on the increased investment, shows a saving of $322 a year, or, that the direct connected drive would pay for the added investment in eight years. Similar figures in connection with the weave room showed a saving of $277. In the above figures, no account has been taken of the saving effected by the reduced cost of maintenance, in neither has the increased production been considered.

A paper by Mr. Sidney B. Paine opened with some interesting statistical data concerning the use of motors in American textile mills, where about 10 per cent. of the power is now furnished by them. He stated that he had detailed records of 128 mills having about 90,000 h.-p. of motors, in which 54,000 h.-p. are employed in mills furnished with current from steam-driven power plants, 33,000 h.-p. are in water-power plants, and the remaining 3,000 h.-p. in plants using both steam and water power. Twenty-two mills are driven by current obtained from independent power companies, a method which has been strongly advocated at previous meetings of the association by many power specialists.

In all its essentials, the system followed in textile mills to-day is the same as that adopted ten years ago. In some few details, improvements have been made. The principal change has been in the direct connection of the motor to the spinning room shaft. In the first mills this arrangement was adopted for the picker room only. There has been a marked advance, however, in the recording and indicating instruments. At first it was necessary to depend upon the ammeter and voltmeter. The use of these instruments was found to be unsatisfactory, as the readings of the ammeter had to be corrected by the readings of the voltmeter, and did not even then give a correct indication of the amount of energy furnished by the motor. The use of the indicating wattmeter corrected this difficulty, but no continuous record could be kept by that instrument. Then followed the curve-drawing wattmeter, by which the record was drawn by a pen on a revolving disc. This was open to the objection that its record, especially on light loads, was too short to be of much service. The latest instrument to be developed is the registering wattmeter, by which the record is drawn upon a strip about 3 inches wide, at the rate of 3 or 6 inches per hour, as may be desired. The duration of this record depends upon the length of the strip.

Some very interesting charts made by these instruments were submitted by Mr. Paine. They were taken in a fine-goods mill and gave the record of a 200-h.-p. motor in a ring-spinning room. No importance was attached to the tests of portions of machinery to determine the power required for a single frame or number of frames. As all frames do not use the same amount of power such figures are considered of little direct value by Mr. Paine. The record for five days' operation of this room was as follows:

POWER CONSUMPTION OF MOTOR IN SPINNING ROOM.

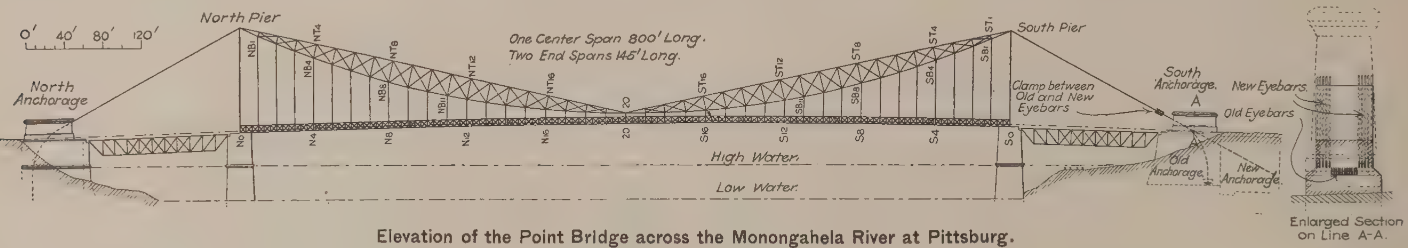
	Percent. of Mach. in Operation.		Spindles per H. P.	
	a. m.	p. m.	a. m	p. m.
Monday	93.6	94.6	69.41	75.97
Tuesday	93.9	98.4	71.97	76.67
Wednesday	95.1	97.1	72.64	74.37
Thursday	94.2	94.6	71.04	74.21
Friday	96.3	96.7	72.32	74.03
Average for five days	94.6	96.3	71.48	74.61
Total average	95.4		72.95	

The results obtained in these tests illustrate the difficulty, Mr. Paine says, which would be experienced in an attempt to obtain similar information by means of indicator cards taken at the engine cylinder. The power required to operate machinery varies from day to day and even between forenoon and afternoon of the same day. If all the frames were in operation at the time of the test, the result would be misleading, as it would be more favorable than if normal conditions had prevailed. Undoubtedly the methods followed in the tests submitted herewith may be improved as more experience is obtained, and other deductions may be made than those noted above. The advocates of the electric system believe that by its use much valuable information may be obtained and that thereby the manufacturer can keep himself informed as to what is transpiring within his mill.

In making these tests, the so-called friction load was ascertained only for comparative purposes, as Mr. Paine considers it does not give the actual efficiency of the drive, merely the energy consumed under conditions which do not prevail when the machinery is in operation. When the belts are on the loose pulleys, the stress and torsion on the shafting and the slipping and creeping of the belts are quite different from what they are when all the machinery is running. Mr. Paine knows of no method to determine accurately the friction losses of a system, either mechanical or electrical, under working conditions. The friction load tests have their use, however, in detecting any change or undue loss from day to day.

At the same meeting Mr. Louis I. Guion presented a paper on the electrical measurement of power at the Columbia Mills, which is obtained from two plants described in this journal on May 5, 1894, and Jan. 1, 1898. For about ten years this plant has been running continuously with the electric drive and with considerable overtime; and many motors have been running much over their normal rating during this time. So far as can be ascertained, the motors, with few exceptions, are as good as the day they were started, and have never given the slightest trouble.

The total frictional load, based on the maximum load with all machinery running under conditions that existed when the tests were made, is 22.4 per cent.; this includes the loss of power consumed by motor. This frictional load could be greatly reduced were counter pulleys with wider faces substituted in many cases (particularly in carding and spinning departments) for the narrow pulleys now in use, so as to allow the use of wider belts, allowing these latter to run slacker than those now in service, which have to be kept excessively tight. At the time these pulleys were put into service, litttle was known as to the amount of power required by the various machines; had the amount of power estimated to run the machinery been correct, the width of belts now in use would have been ample. The maximum load is never thrown on the entire mill at any one time; and seldom is the maximum load on any one motor at any time; still the motor is a unit, and is liable to have to carry its maximum load momentarily, and for some minutes, occasionally, and it is therefore necessary to have belts ample to transmit the maximum load without having them unduly tight. If this precaution is not taken, the belts will be a constant source of annoyance, either running off when load is thrown on, or, what is more serious, slipping constantly, causing irregular speed, bad work, and low production. When belts must be kept unduly tight to prevent slip-

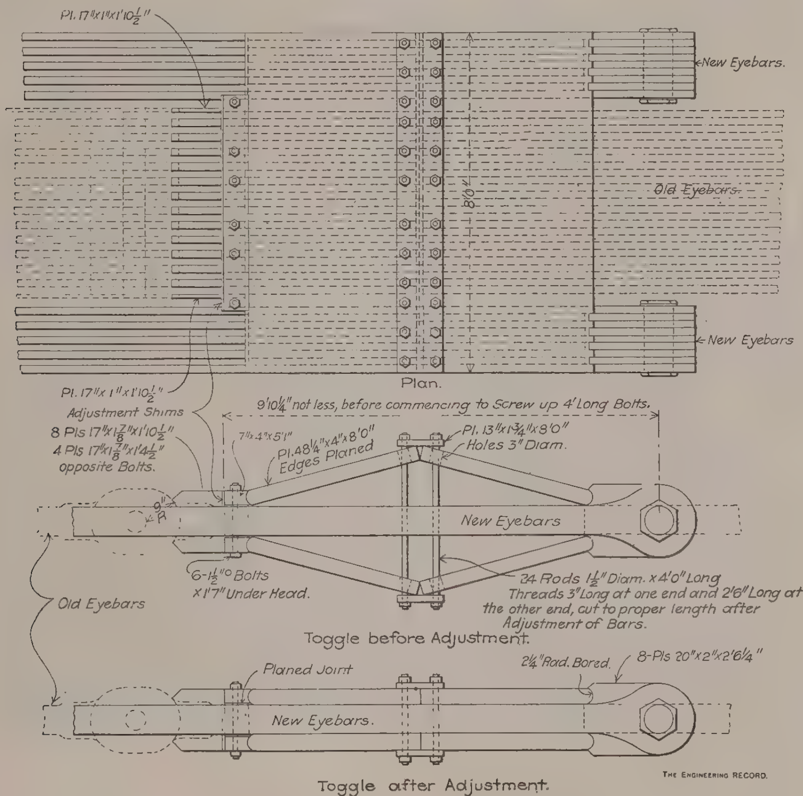


Elevation of the Point Bridge across the Monongahela River at Pittsburg.

ping, it is necessary to be constantly taking them up and rarely is the same tension obtained at these various times. Mr. Guion consequently believes that when belts are used that are not of ample carrying capacity, there is no such thing as even speed.

On Jan. 10, 1905, in testing a motor, we found that the shafting of the motor drive was taking up 55 per cent. of the power put into the motor; after working two hours for three nights on this shafting, the friction load was reduced to 22.3 per cent., with a resultant saving of 21.25 h.-p. Had this shaft been driven by the ordinary mechanical method, the trouble could not have been located, and perhaps it would have run six months before being corrected.

The total nominal rating of the 21 motors in the mill was 1,590 h.-p., while the full-load tests show 1,748.77 h.-p. with 129.78 h.-p. to be added for estimated horse power of machinery idle. This would give 1,878.55 h.-p. as being required to drive the mill, if all the machinery was operated at one time. It is therefore evident that to drive all the machinery operated by these motors simultaneously requires 15.3 per cent. more than the normal rating of the motors. This condition, however, never arises in any mill, especially in one having as coarse work as this.



Toggle for Adjusting and Connecting New Eyebars.

During 1903, the average power consumed by these various motors was 1,516 h.-p., and during 1904, 1,531 h.-p., measured at the switchboards by registering wattmeters. The line loss is from switchboard to motors; it is between three and four per cent., the distance being from 700 to 1,000 ft.

There is 11.6 lb. of shafting, pulleys and other rotating material per spindle, or 3.43 times as much rotating material and four times the number of hangers per spindle as in the Olympia Mills. Yet the friction load given was 21.81 per cent. as the results of trials at that mill, while for the Columbia Co., in spite of the greater weight of shafting, etc., the friction load is only 22.4 per cent. This condition may be due to the fact that the Columbia motors are running at full load, and therefore at high efficiency, while the Olympia motors were running far below their normal rating, and therefore at a low efficiency, with but few exceptions. This clearly shows the necessity of using a motor of proper size to drive a given amount of machinery.

Mr. Guion gives a table which shows that by increasing the speed 10½ per cent. from 6,764 r.p.m., there is a loss of 6.2 per cent. in number of spindles run, per horse power. By increasing speed 24 per cent., there is a decrease in the number of spindles per h.-p. of 25.8 per cent.

The results obtained by the tests illustrate the inaccuracy inevitable with the differential method. Such a plan assumes that each of the machines, similar in design and on the same class of work, consumed the same amount of power. Everyone familiar with machinery is fully aware that this is not the case. For instance, no two spinning frames are in the same physical condition. No two frames are banded under the same tension. This differential method, however, is the usual method employed, and was therefore followed in these tests.

The results of the test are given in great detail in the paper and need not be summarized here, as the purpose of this abstract is merely to call attention to the fact of the tests in one of the first mills to use the electric drive. Mr. Guion states that the motor installation is not as good as one which could be laid out to-day in the light of experience gained since the mill was built. He is well convinced that where electricity can be generated on a jack shaft in wheel room and the mill owns its own power plant, the electric driven mill, under these circumstances, is very desirable. As to the electric driven mill where current is generated by steam power, the question as to point of economy, either in installation or operation, is one yet to be settled, he believes. There are no figures from any cotton mill plants that lead him to the conclusion that the electric drive is as economical as the hundreds of plants running which have modern steam power and the ordinary direct belt or rope drive.

The Reconstruction of the Point Bridge, Pittsburg.—I.

The Point bridge, across the Monongahela River just above its confluence with the Allegheny River, Pittsburg, was designed by Mr. Edward Hemberlee, chief engineer, and built in 1876-7 by the American Bridge Co. for the Point Bridge Co., who owned and operated it as a toll bridge until all the stock was purchased by the city in 1896. It was about 1,250 ft. in total length, 80 ft. high in the clear above low water and carried a 20-ft. roadway and two 7-ft. sidewalks. It had two abutment or anchorage piers and two river piers of stone masonry which supported an 800-ft. center span and two 145-ft. shore spans, the latter each having two pin-connected deck Pratt trusses about 16 ft. deep. The center span is of the link-suspension type with two iron towers about 110 ft. high on each of the river piers. The towers support the chain cables made of 8-in. iron eyebars 20 ft. long on centers.

Each tower is made with four battered posts of rectangular cross section which are connected by lattice bars on all sides and have their upper ends united by plate girders carrying a platform supporting a roller bed and saddle consisting of short horizontal links receiving the upper ends of the eyebar chains at both ends. The two towers on each pier are connected by transverse braces and arched portals and were surmounted by ornamental finials. The base plates of each pair of tower columns were connected by longitudinal horizontal 12x1-in. tie plates on which they were seated on the pier masonry. At the shore ends the anchor chains were built solid into the anchorage piers where they were deflected in long radius curves to vertical lines terminating at their connections to large cast iron reaction plates.

Between the towers the chains are stiffened with pairs of trusses extending from the tower tops to the center of the span. Each truss is 23 ft. deep in the center, with a straight top chord and curved bottom chord intersecting at the ends. The bottom chord is formed of the eyebars in the suspension chain and the top chord has a rectangular cross section made with two channels and a cover plate. The vertical posts are I-beams and the diagonals are screw ended rods. The floor platform was suspended from the eyebar pins by pairs of vertical 1⅜-in. upset bars with sleeve nut adjustments. It was stiffened by longitudinal riveted trusses 8 ft. deep in the planes of the suspension chains, which were made in sections about 100 ft. long, each corresponding to five panels of the floor system and connected with the adjacent sections by web-splice cover plates and bolts in slotted holes making expansion adjustments. The trusses are divided into nearly square panels by vertical members and each panel is X-braced by flat bars.

The old floor beams were very light lattice girders 33 in. deep, made with top and bottom T-shape flanges built up with two light angles and a cover plate. The web members were simple thin narrow flat diagonal bars. There were two lines of stringers 24 in. deep, similar to the floorbeams, which carried wooden transverse joists covered with longitudinal floor planks. There was practically no transverse or lateral bracing except two 2½-in. wire storm cables in parabolic horizontal curves reaching from the ends of the main piers to the center of the span and intersecting at the quarter-span points. The anchor piers were built of a poor quality of stone masonry with coursed faces and rubble backing, the latter apparently laid dry and grouted. The eyebar chains were not grouted or sealed in the masonry and many cavities existed in the masonry and around the eyebars. The extreme dimensions of the anchorage piers are about 76 ft. long and 60 ft. wide at the footing and 80 ft. in extreme height, and a considerable space was occupied by a 20 x 25 ft. interior well.

The bridge sustains a heavy traffic of teams and wagons with many heavy coal and iron trucks and carried at first horse cars and then much heavier electric cars, which have increased until they now average about 2,250 in 24 hours. The superstructure was never well maintained, seldom painted, and soon began to show signs of weakness under service much heavier than it was designed for.

A thorough inspection and report of its condition and plans for its repairs were made in 1897 by Mr. John Brunner for Mr. E. M. Bigelow, Director of the Department of Public Works of Pittsburg, but no appropriation could then be secured for executing the repairs. In 1901 the plans were revised by Mr. Willis Whited, assistant engineer of the department of public works, but no action was taken until after it was discovered in December, 1903, that three floorbeams were broken and the bridge was closed to heavy traffic. Temporary repairs were at once made and a $92,000 contract for complete repairs was made with the Pitsburg Construction Co., who executed the work to be described in these articles.

Condition of Bridge Before Repairs.—In December, 1903, the broken floorbeams were reinforced by placing under each of them a 24-in I-beam suspended by four 1½-in. vertical screw bolts at each end and light traffic was maintained until May when the bridge was closed and complete repairs and reconstruction of the floor system were commenced. It was found that the north anchorage was in good condition, the eyebar chains there were not seriously corroded and therefore the reinforcement which had been under consideration there was deemed unnecessary. The south anchorage pier had been displaced several inches from its original position by slipping bodily on the hard wet clay and the eyebars were badly pitted with rust for a length of about 6 ft. where they entered the top of the masonry; elsewhere they were apparently unimpaired. It was decided to reinforce this anchorage by adding to the old chains new lines of eyebars with anchorages in extensions of the reaction masonry.

The approach spans were found in good condition except for corrosion and that they were too light, and a new center truss was added between the old ones in each span. Most parts of the main span were corroded to an extent which in some places was very serious and greatly reduced the strength of the members; in other places, including parts of the towers, eyebar chains and upper stiffening trusses, the deterioration from this cause was immaterial and although the iron was carefully examined no evidence of crystallization or deterioration from overwork was observed. The worst corrosion of the upper part of the structure was noticed at the intersections of lattice bars and where the riveting was not close or tight enough and moisture had penetrated between plates and shapes and the rust had forced them farther apart, and in the interior of the box girders at the tops of the towers. Some of the bottom struts in the approach spans were badly but not dangerously rusted, and the ornamental cast iron bases of the towers and the horizontal tie plates between their bases were almost eaten through and completely destroyed.

The floor system in both approach and center spans was badly corroded on account of neglect, from the action of the salt freely used in winter on the road and by the gases from the soft coal burning steamers passing under the bridge in great numbers. In the approach spans some of the long shallow plate girder floor beams were so badly rusted that all the top flange cover plates and many of the flange angles were reduced to thin, open laminations. In the main span all the floor beams were in bad condition, one was broken in the middle through the web and flange, eight had failed by buckling of end lattice bars, and two had cracked flange angles. The flange angles and flange cover plates were rusted entirely through in some places, and so as to separate the iron into thin laminations in many places, many rivets were loose or headless and corrosion between plates and angles, especially where the bottom flange angles separated by the web lattice bars formed pockets collecting moisture, was sufficient to force the plates ⅛ to ¼ in. apart. The areas of some of the top flanges of the floor beams had been reduced 30 per cent. by corrosion which was much worse than in the bottom flanges; the condition of the stringers was similar to that of the floorbeams.

The tower struts were repaired and concrete filling was placed in them and in the saddles and box girders to prevent the future accumulation of water. New finials were built, the bases of the towers were reinforced, the bottoms of the columns filled with concrete and provided with concrete fenders. The lower stiffening trusses were repaired and reinforced, and the entire floor system and hangers were replaced with new and heavier members of different design. Other minor repairs and auxiliary work was executed and the superstructure was thoroughly painted and put in first-class condition.

Old Floorbeam, Broken and Corroded in Service.

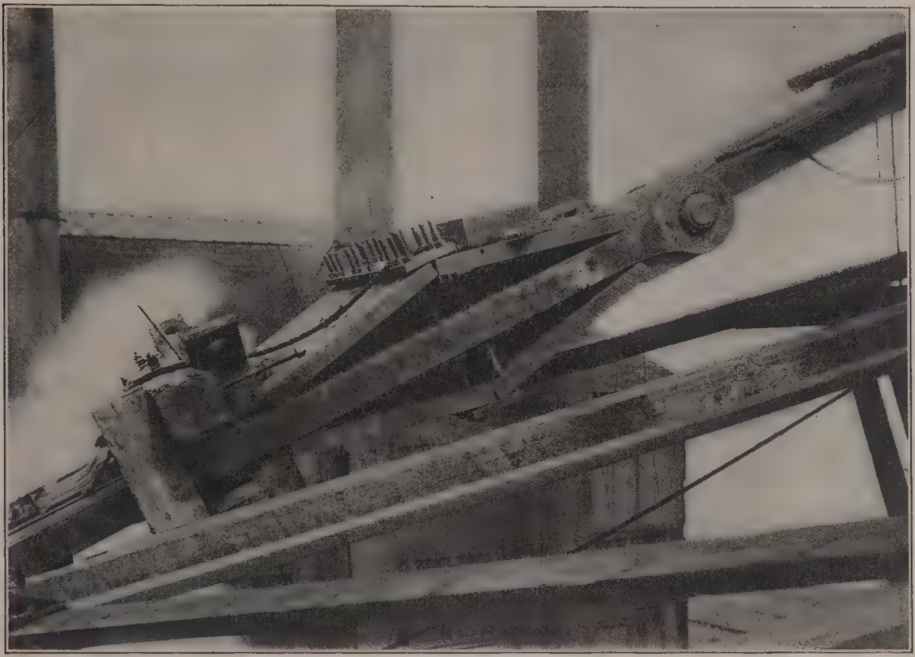
Reinforcement of Anchorages.—The masonry of the north anchorage was cut out to permit the inspection of the eyebars, which were found satisfactory and grouted with 2:1 Lehigh Portland cement and the masonry restored. The reinforcement for each suspension chain at the south anchorage consists of three panels of steel eyebars having a total length of 144 ft. and a united cross section of 160 sq. in., which are connected to the old eyebars and tangent to them above where they enter the anchorage masonry and extend in a straight line to an inclined reaction platform bedded in a 14 x 63-ft. concrete extension 60 ft. deep in the rear of the old pier. The eyebars are divided into two groups for each chain. One group is placed on each side of the original chain with the upper and lower edges of the old and new bars in the same planes at the upper end of the new bars, and consists of alternate panels of five 2 x 8-in. bars and four 2½ x 8-in. bars connected by 8 and 10-in. pins and connected at the lower end to separate 9 x 5-ft. reaction grillages, each composed of six 24-in., 100-lb. I-beams with reinforced webs, bottom flange end tie plates and full length top flange cover plates.

The new eyebars are connected to the old eyebars by means of four 4-in. transverse plates 4 ft. wide and 8 ft. long, clamped to the upper and lower edges of the eyebars and having their outside horizontal edges bearing in segmental grooves cut in the vertical edges of plates placed between the eyebars and engaging the heads of the old eyebars and the pins of the new eyebars. The old and new eyebars lap past the points of connection so that the tension transmitted from the former to the latter produces compression in the connection plates and permitted them to be arranged at first as a temporary toggle, the operation of which gradually and accurately transferred the required amount of stress from the old to the new anchorage.

Operations were commenced by the installation of six boom derricks and five Lidgerwood and Lambert hoisting engines, three of them with separate steam boilers, by which materials were handled and the old floor was removed from the main and north shore spans and the new anchorage excavation made. A separate pit on each side of the bridge axis was dug by hand through clay, shale and large slabs of rock which had been displaced many years before by a landslide. Very little water was encountered and that which drained in from the surface quickly disappeared. The spoil was shoveled into 1½-yd. boxes hoisted by a derrick seated on the surface between the two pits, set on cars, hauled by a cable operated by a hoisting engine and delivered to a second derrick which lowered them through an opening in the bridge floor and dumped them into barges in the river. The sides of the pits were sheeted with 3-in. beech sheet piles braced with 12 x 12-in. horizontal yellow pine struts 4 to 6 ft. apart vertically.

Many large stones were left partly bedded in the solid walls of the pit so as to give increased bond with the 1:3:5 concrete with which the pits were filled. Three alternate courses of the old masonry near the bottom of the pit were recessed to a depth of 24 in. on the rear face and concrete filled into these spaces as it was rammed in the bottom of the pit nearly up to the lower edges of the new eyebars, thus bonding the old and new masonry together and increasing the resistance of the former against uplift. Cement from a storehouse under the south approach span was delivered to the sand and stone barges in the river and one barge being floored and provided with two derricks was used as a measuring platform where several one-yd. batches of concrete were simultaneously hand-mixed, shoveled into stel buckets, hoisted by a derrick on the bridge floor, deposited on trucks, hauled by a cable from a hoisting engine and finally lowered into the pits by a second derrick. This work was carried on continuously night and day by a force of about 150 men.

After the concrete in the pits had well set the new reaction platforms and eyebar chains were assembled and lined up and the upper part of the masonry in the old anchorage over the portions of the old chains where it was desired to place the new eyebars was removed first on one side and then, after connections had been made there, on the other side. As soon as the old masonry was removed the surface was dressed and a large amount of Portland cement grout was injected in the remaining part and allowed to set several days before the connections were made between the old and new chains which at the upper ends of the latter were close together and parallel.


Toggle Connecting Old and New Eyebars before Adjustment.

The new eyebars were lined up on blocking and their upper ends were supported on false-work trestle bents. The members of the toggle connection were assembled by a derrick and bolted together, clamping them securely to the old eyebars, and thus loosely connecting the new to the old bars. The lower ends of the reaction beams were forced downwards, parallel to the eyebars, by wooden blocks wedged between them and the concrete on the river side, and two 30-ton hydraulic jacks were set against the upper ends of the beams of each grillage on the river side parallel with the eyebars and reacting against the concrete, were operated to their full capacity to force the grillages as far down as possible, thus developing an initial stress of about from 150,000 to 200,000 lb. in each pair of new eyebar chains and toggle, reducing the stress in the lower end only of the old chain by the same amount and transferring this portion of the reaction from the old to the new masonry. Concrete was then rammed in front of the grillage beams up to and around the jacks, and after it had set several days the jacks were removed and the spaces they had filled were concreted.

Two fine horizontal transverse lines 33 ft. apart were scribed across the upper edges of the new eyebars near their upper ends and the 4-ft. vertical bolts which pass between the eyebars and connect the upper and lower toggle plates were screwed up about 2 in. at each end. This caused an elongation of ⅛ in. between the 33 ft. marks on the new eyebars, all of which stretched uniformly within 0.01 in. Assuming a modulus of elasticity of 29,000,000 lb. this elongation corresponded to a stress of 9,150 lb. per sq. in. in the new bars, or a total of 1,464,000 lb. for each chain. It was then calculated that entirely closing the toggle plates would stretch the eyebars ¾-in. between the 33 ft. marks, but as a less total elongation corresponded to the required stress the toggles were slacked off and the shims previously inserted between the lower heel strips and eyebar plates were replaced by new ones ¼ in. thick, designed to allow the plates to be screwed down flat and produce the proper stress. This was done and the operating bolts were cut off flush with their nuts. Concrete was filled in over the new eyebars, completing the pier extensions, and the upper part of the pier which had been removed to expose the old eyebars was rebuilt with concrete rammed in moulds of 2-in. dressed tongue and grooved yellow pine.

View of Old Anchorage and New Eyebars.

(To be continued.)

Boiler Plants in Bleaching and Dyeing Mills.

A few months ago Mr. George I. Rockwood contributed a letter to this journal outlining his views concerning the design of boiler plants. At the meeting of the New England Cotton Manufacturers' Association last month he explained these views in greater detail, as applied to the boiler plants in bleaching and dyeing mills. The power requirements in such mills are small, while a large amount of steam is required for kiers, dry-cans, dye-tubs, ageing machines and other plant. The machines to be driven are widely scattered. The cost of an electric generator and motors is relatively small; and to establish the policy of concentration made possible by the use of the electric transmission of power is of great importance to the subsequent growth or alteration of the plant as a whole. The steam turbine cannot be used unless the electric drive is also used. But the turbine has an advantage, as a source of dye-house or print-works power, over the reciprocating engine in one important particular, namely: its exhaust steam is pure and uncontaminated with cylinder oil and can be used in creating a hot-water supply in the place of live steam. It may be said, in passing, that electric motors should not be put up inside the bleacheries themselves, nor in any place where fumes or vapor can harm them, otherwise they may prove expensive indeed.

One reason why it is very desirable to consolidate the power in one spot is that the cost of highly paid engineers is reduced to that of one man, and he may quite as well be the same individual as the chief engineer of the consolidated boiler house if the engine room adjoins the boiler room. In a particular mill where two or three years ago there were 31 Corliss boilers of the older types—rolling-pin and centennial—18 of which were used for manufacturing purposes and the rest for power, a saving, by consolidation into one modern boiler house and steam turbine plant, was effected amounting to $75 per diem for coal and to $14.40

for reduced labor; and this with an increase of wages paid the single chief engineer of $1 per diem. Yet the greatest advantage of the consolidation to these mills was prospective rather than actual, for in the future they have but to extend this boiler house and turbine plant to provide any reasonable increase without further expense for a chief engineer, besides saving many minor expenses.

In order that one chief engineer may be able to watch effectively the daily routine of a large power and boiler plant, one thing must be uppermost in designing the original layout: it should be compact and of such shape and dimensions that the engineer can easily see and speak to every fireman, coalpasser and oiler without moving about much himself. The limit to the size of a boiler plant which one man can properly oversee in this way may be placed at something over 5,000 b. h. p. Obviously, no labor is saved by concentrating in one unit a larger plant than can be carefully attended to by a single engineer; a self-evident truth, but it seems to have been overlooked completely by the designers of the great metropolitan electric power stations, and may be emphasized now, as mill engineers have been turning more and more to these stations for inspiration in handling the design of the larger industrial boiler plants of the sort we are now discussing.

Just what design of boiler plant constitutes the best possible arrangement is something of a riddle. The key is found in devising a satisfactory coal-handling scheme. The plant which has the most economical coal-handling methods in use will be the most economical producer of steam; so that the answer to all other questions of design should wait until after the designer has fully convinced himself on this point. There are three or four different methods in common use, but it is safe to say that the most common way found to-day in New England boiler houses is to team the coal from the railroad or schooner to a coal-dump near the boiler house, and then to wheelbarrow it from the dump to the furnaces, into which it is fired by hand. This takes men. How much capital should one invest in plant and machinery to save the labor of one man? If the money can be borrowed at 5 per cent., that much must be saved clear anyway. The life of power machinery cannot be set at longer than twenty years for fear of its becoming obsolete then, even if not worn out; this means another 5 per cent. To this must be added about 6 per cent. for repairs, insurance, supplies and taxes. In round numbers, therefore, 16 per cent. of the investment should not be a larger sum than the wages saved. So the safe rule is to multiply by six the wages it is proposed in any case to save by investment in machinery and buildings, and the product represents the limit of prudent capital expenditure where the purpose is solely to save wages. Judged by the application of this rule, the coal team, barrow and human stoker combination will be found the least economical of any, except that most modern of all designs, namely, a structural steel boiler house, having an expensive steel construction for supporting the boilers, and boiler-room story above an ash-collecting floor; another story above the boiler room for economizers and smoke-flues, and, away up fifty feet in the air, a great steel and masonry coal-storage pocket served by a bucket or belt conveyer and discharging the coal by gravity, through pipes, into the hoppers of mechanical stokers. The fixed charges on such a structure will be found so great that nothing but the most excessive cost of land—such as rules in the down-town portion of New York City—will justify it, even if that ever does.

It will be found, on investigation, that all the advantages of the modern boiler house may be had with far less expense if the coal pocket be placed directly on the ground and on one side or end of the boiler plant proper. By thus leaving the roof of the boiler house unencumbered with the coal pocket, not only is the simplest and cheapest structural-steel design possible, but a skylight over the center aisle between the boilers makes the whole boiler room light, airy and fit for a decent man to work in; whereas, some of these modern boiler rooms can only be compared with underground dungeons.

Mr. Rockwood illustrated his suggestions by reference to a boiler house with mechanical stokers served by coal tipcars, running on tracks at a level just above small bunkers suspended directly over each stoker and holding each one ton. The capacity of two men, whose combined wages amount to $1,000 per annum, is 5,000 b.h.p. when pushing a car holding one ton of coal. They have to push the car an average distance of 100 ft. from under a hopper in a 2,000-ton coal pocket to the individual stoker bunkers. As it is impossible to operate any mechanical coal-distributing plant with less than $1,000 wages per annum, nothing would be saved by overhead construction and gravity distribution. That is to say, men must be attending to automatic scales, or starting along the coal in the vertical coal distributing pipes when it refuses to descend. But even if the whole sum of $1,000 per annum could be saved by overhead construction, this, by the rule, would permit a maximum expenditure of $6,000—a sum totally inadequate.

A coal-pocket built directly on the ground and enveloped by a bucket conveyor could be made entirely of wood, tied together with iron rods. If placed over the boilers it must be of steel and lined with concrete or brick. In the coal pocket of the plant referred to, the conveyor passes right around the pocket endwise, and (1) may be used for emptying the bin into which the electric coal cars discharge their loads and conveying the coal up and into the pocket at any desired point longitudinally; or (2) it may be used for turning over the pile from the bottom to the top in the event of heating; or (3) it may be used to elevate the daily supply of coal for the boiler house into an isolated bin at a high elevation, from which it may be drawn by gravity into the coal tipcars, as stated above, for distribution to the stokers. A 2,000-ton pocket, exclusive of the land, costs completed, with coal crusher, conveying machinery, electric motors for driving them, receiving hopper foundations, and elevated bins, about $20,000. Its advantages over a mere dump are (1) it enables coal to be received in storage without either a first or second shoveling; (2) it stores coal economically as to extent of land; (3) the conveyor saves the coal in case of spontaneous combustion; (4) the conveyor permits accurate measurement of mixtures of anthracite with bituminous coal; (5) the elevated bins from which the tipcars get their supply by gravity are filled from the pocket by the same conveyor. Fire is less likely to occur by spontaneous combustion in a wooden pocket than in the tight steel pockets of the kind necessary if put over the boilers, because the sides and bottom of the wooden pocket are open slightly between the planks, thus aerating the coal. If the coal does catch fire it is easier to extinguish it, and the wooden lining is cheaper to renew. A pocket is of advantage near a bleachery, because it limits the flying coal dust.

With regard to the best type of boiler, Mr. Rockwood has no fault to find with the upright firetube kind. A preference for this type is based on its price, $7.50 a horse-power erected, its compactness, the ease with which tubes may be swept, and the fact that it gives superheated steam. It is a great steamer, and there is nothing to choose between its economy and that of any other correctly designed boiler and furnace. It is desirable, however, that only clean, soft water shall be fed to a boiler of this type. If scaly waters are to be used, the Babcock & Wilcox or Stirling water-tube boilers are to be preferred, Mr. Rockwood says.

Economizers are frequently omitted from otherwise first-rate plants. This, however, is unquestionably a mistake, as they take the place of just so much heating surface, if similarly placed in the boilers, and deal with comparatively cool water which could not be dealt with in a boiler so effectively. It would be better to deliberately install fewer boilers and supplement them with economizers, than to try to do the whole work with boilers. A temperature of 600° or even 650° Fahr. is not too hot for the gases as they issue from the boilers where economizers are used; yet 400° to 500° are much more common figures. Economizers save about 9 per cent. of the total fuel bill. In a certain plant the economizers cost, completely installed, and making due allowances for the extra cost of the boiler house because of their presence, something less than $15,000. The coal burned per annum is about 15,000 tons, which at $3 a ton equals $45,000. Nine per cent. of $45,000 = $4,050, which is 27 per cent. of their cost, or 11 per cent. more than the 16 per cent. necessary according to the rule given above.

Mechanical draft versus chimney draft is another question not fully settled in the minds of experts. For bleacheries, however, both should be provided. The chimney is needed because the soot must be discharged at a high altitude to avoid contact with white goods. By means of the fan a smaller installation of boilers will do the work of supplying sudden demands of dye-house or bleachery for gusts of steam for an hour or two, than would otherwise be required. This is much the more economical scheme as compared with the large reservoir of hot water idea, embodied in a much larger boiler plant than the fan would make necessary and working the greater part of the day very lazily under a light chimney draft, simply to be there when the heavy demands for steam come. It is not, apparently, generally realized that a stoker grate is more durable under a heavy fire than under a light one; and sudden changes from heavy fires to light ones cause the grate to burn out very fast. Again, a mechanical draft system, costing $5,000 installed, will do the work of sixteen 220 horse-power boilers with twelve, the sixteen having only a 175-ft. stack. Each boiler with its full equipment and building costs about $8,000. The difference between sixteen and twelve is four boilers saved, or $32,000. Thus there can be no question as to the desirability of providing both chimney and fan in this class of boiler plants; and the same thing has been found true in large electric power plants.

Boilers in textile mill plants are still very rarely connected up to their mains in such a manner as to avoid water pockets; and the special advantage to mills of perfect natural drainage is that it affords the night fireman more complete security and ease in "cutting in" boilers after internal cleaning, as he "fires up" for the morning start. Often the region around the main valves is very dark, hot, dirty and accessible only by means of a rickety ladder, and it is a matter of considerable danger to open drain cocks and connect up the boilers and main. All this is unnecessary, and avoidable by forethought in the general layout of building and piping.

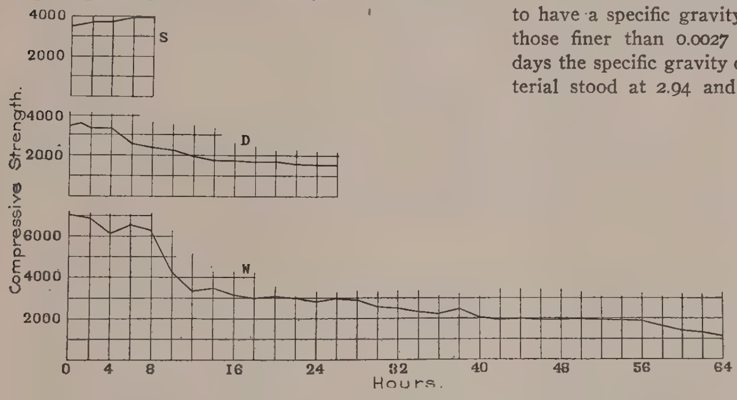
The building should, of course, be fireproof. Not only should all trusses be of steel, to avoid stresses on pipe lines and machinery due to the shrinkage of wood, but the roof itself should be of some durable fireproof, non-shrinkable and non-corrosive material. Cinder-concrete and expanded-metal are as good as anything. Slate may be nailed directly to the concrete, if done before it is too dry and hard.

Tests of Cements at the Watertown Arsenal.

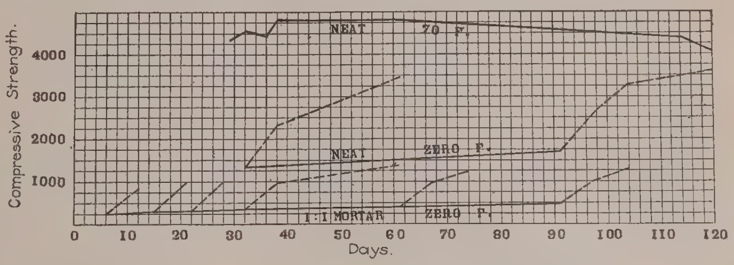
A paper read before the Association of American Portland Cement Manufacturers on April 12, by Mr. James E. Howard.

In response to your kind invitation, I have the pleasure of bringing to your attention the tests of cements made at the Watertown Arsenal during the past four years. Earlier tests were made, but are wanting in some of the elements of continuity which it was intended should characterize the present series which was inaugurated in the year 1900, and since then continued.

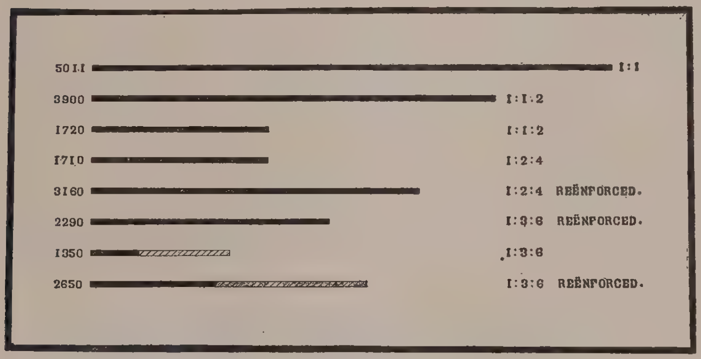
Fineness of Grinding.—The inquiry began with observations on the fineness of grinding. It was found convenient to designate the material, separated by sifting, by the size of the grains, instead of the usual rating of the sieve by the number of its meshes. Thus a 100-mesh sieve has openings 0.0058-in. in diameter; a 200-mesh sieve 0.0031 in., while a No. 20 bolting cloth, the finest sieve available, has openings measuring only 0.0027 in. in diameter. This grade of bolting cloth reaches the practical limit of fineness, although the material which passed through was further separated into different grades by means of a winnowing device. A few briquettes were made with this finer material, but with no unusual results. For reasons which will be referred to, it is held that the fineness of grinding should be ascertained by means of sieves at least no coarser than the No. 20 bolting cloth, separating into two grades only. This is recommended since it is impracticable to obtain or use a finer sieve; otherwise a finer limit of demarkation between the coarse and the fine material would be preferred.



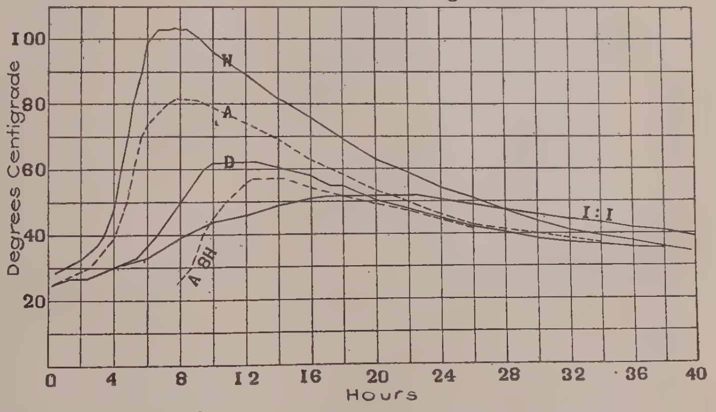
Cements Held for Different Periods in the Mixing before Setting Undisturbed.



Effect of Low Temperatures on Strength of Cement.



Relative Strength of Mortar and Concrete Columns.



Temperatures Acquired by Cements in 12-In. Cubes while Setting.

Specific Gravity Determinations.—These furnished values for the freshly ground Portlands in the vicinity of 3.10. There were a number of natural cements examined which had substantially the same values as the Portlands, although some brands fell below 3. Hydration, partial or complete, lowers the specific gravity. Exposure of the loose material to the open air for a few weeks reduces this value sufficiently to admit of demonstration. The effect is more readily shown, however, by noting its loss in weight when subsequently heated.

Hydrated cement, reground, has a specific gravity ranging from 2.50 to 2.70, that which was set in water being found slightly lighter than that which was set in air. This change in volume is progressive, requiring hours, or even days, for its full accomplishment, and the rate of change appears to be different in the different size grains. The finer particles are more promptly affected than the coarser ones. Determinations which were made at different times, from one-half hour up to five days after gauging, showed a continued decrease in specific gravity during this time. Samples gauged with hot water were lighter at each successive stage than corresponding ones gauged with cold water.

As to the influence of the size of grain, determinations made 30 minutes after gauging showed those which were coarser than 0.0058 in. diameter to have a specific gravity of 3.04, against 2.72 for those finer than 0.0027 in. At the end of five days the specific gravity of the coarse and fine material stood at 2.94 and 2.68, respectively. This variation in the rate of hydration of the coarse and the fine particles is taken as a reason for preferring fine grinding. It is thought to point out why some benefit to the cement as a whole may be expected from a certain amount of air seasoning, in that it permits the finer and more active parts to hydrate in advance of the main batch, and lessens the danger of subsequent internal disrupting forces.

If a minimum specific gravity represents the state of complete hydration, it follows that the coarser grains just mentioned, which had a specific gravity of 2.94 at the end of five days, were not completely hydrated. This behavior of the coarser material has a bearing on the question of the time required for setting, since material which has not yet hydrated can hardly be said to have set. From this point of view it would seem that the usual methods of judging of the time of setting consisted in the selection of an interval, recognized by its conformity with arbitrary definitions, which may perchance indicate neither the beginning nor the ending of this stage.

A certain loss in weight usually occurs upon heating cement fresh from the barrel, and that loss has been found twice as great with grains finer than 0.0027 in. diameter than with those which were coarser than 0.0058 in. diameter. These results again lead to the inference that the time of setting begins when the clinker is ground, or perhaps as soon as it becomes clinker, cools, and is exposed to damp air.

Allied to the subject of specific gravity is the loss in weight upon heating. The losses with freshly ground material are small but increase after exposure for a time to the air, while greater losses occur in the treatment of gauged material.

It would be confusing to mention specifically the actual results of the many determinations, but in some examples the losses of the loose material ranged from about half of one per cent. to 2¼ per cent., according to time of exposure. Coarse particles lost one per cent., while the finer ones lost twice that amount after similar conditions of exposure. Differences due to size of grain, conspicuous in the air-exposed cement, were more pronounced in the hydrated state.

Determinations were made of the amount of water retained by the hydrated material. A fixed quantity was not found in a given brand after different conditions of setting; perhaps it should not be expected. Heterogeneity in size of grain seemed the cause of many of these peculiarities. It may be added that water was driven off, in certain of these determinations, at successive increments of temperature, 200°, 300°, 400° Cent., and so on up to redness, heating to a constant weight at each temperature.

Illustrating still further the influence of the size of grain, or what is taken to be such an example, some fragments of tensile briquettes will be exhibited, and the debris of certain others. [The speaker here called attention to exhibits before the meeting.] The half-briquettes which are now hard and strong were made from a batch of mortar composed of equal parts of fine cement and granite dust. The disintegrated, coarse, loose material once formed similar briquettes. This mixture was of equal parts of fine and coarse cement, substituting for the granite dust of the former batch coarse cement of the same diameter of grains. The second lot of briquettes remained intact for about two years, after which the material swelled and fell to pieces. The only explanation of this behavior which has presented itself is that retarded hydration of the coarser particles eventually took place and disrupted the finer portions which had promptly set when the briquettes were first made.

Use of Old Mortar.—The term "time of setting" has been used. Its meaning is not always clear, but in general has reference to a period which follows gauging. It is customary, in specifications, to demand that cement be in place before a certain interval of time has elapsed and not loaded until another period has elapsed, and we are encouraged to believe that the time of setting has taken place in the interim.

Tests were made to ascertain the effect, on final strength, of delaying the time of putting the gauged material into the molds. Some samples were immediately drawn, tamped into the molds and set thereafter undisturbed; while at later intervals other material was taken from the mixing bed and similarly treated. In one series the material was kept in the mixing bed a period of 102 hours before the last samples were drawn. Cementitious properties still remained in the material, as shown by the possession of compressive strength when subsequently tested at the age of one month.

Interest attaches chiefly, however, to the behavior of the material which was kept in the mixing bed for a few hours only, or used during the day it was mixed. The results of some representative tests are shown on the diagram of cements held in the mixing bed different periods before setting undisturbed. A domestic Portland is shown by the lower curve. This was 28 days old from the time of grinding. It was gauged initially with 28.6 per cent. water, by weight. More water was added from time to time as samples were taken out at two-hour intervals, in order to keep the batch plastic. The largest successive increment of water needed for this purpose was added ten hours after mixing. The total quantity of water eventually used was nearly double the original amount. Tests were made when the samples, four-inch cubes, were about one month old. Those which were placed in the molds immediately after gauging had a crushing strength of 7,000 lbs. per sq. in. The strength was well maintained for a period of 8 hours, at which time the strength was still above 6,000 lbs. per sq. in. Cubes delayed 24 hours had nearly 3,000 lbs. strength, and those delayed 2½ days displayed a strength of about one-fifth of the ordinary strength of the batch.

A German Portland was delayed in the mixing bed a total interval of 25 hours. The original crushing strength was about 3,600 lbs. per sq. in. At the end of 8 hours this had a strength of 2,400 lbs. per sq. in.—that is, two-thirds of the primitive strength remained. At 25 hours, 44 per cent remained.

In another case, not shown on the diagram, a domestic Portland developed practically the same strength in each of the several samples up to the limit of 8 hours' delay, while still another domestic brand chanced to show higher strength in the 6 and 8-hour samples over those taken out of the mixing bed at earlier hours. There were brands which did not display so favorable results as these described, but in general a considerable part of the strength was retained by samples delayed not over 8 hours.

These results should tend to relieve undue anxiety concerning the necessity of the very early use of cement after gauging. The inquiry was extended along these lines to material which was hardened for several days and then broken up and reground in a mortar. A Portland, which had become so hard that a pickaxe was needed to break it up, was reground and regauged six days and two hours after the original gauging. Even after so long a time as this the material reacquired strength, and at the age of one month was found to have a compressive strength of 700 lbs. per sq. in. The normal strength at this age was in the vicinity of 6,000 lbs.

A natural cement was experimented upon which set sufficiently in 45 minutes to become resonant. The material for test purposes was scraped off the main batch. That which was scraped off two days after the original gauging and then made into cubes had a strength at the end of a month of one-half the normal value.

Grouts were made in the afternoon and used the following morning, retempering in some cases; in others, surplus water was removed. At the end of 30 days the compressive strength ranged from 2,000 to above 3,000 lbs. per sq. in.

Rise in Temperature during Setting.—Observations were made on the rise in temperature of cements while setting. In small lumps no decided change in temperature occurs; as the size of the lump or cube increases the rise becomes very marked. The temperature curves shown on the diagram were obtained with 12-in. cubes.

The curve represented by the letter W represents a domestic Portland gauged with 25.2 per cent. water when 20 days old from the time of grinding. The rise during the first two or three hours was a moderate one, but had an increasing tendency. Soon thereafter it became rapid, and reached a maximum of 103.5° Cent. in 6 or 7 hours. A gradual decline followed, but the center of the cube still remained above the temperature of the room at the end of 40 hours.

Curve D represents a foreign Portland. Its maximum temperature was 63° Cent., which was reached in about 12 hours.

There are two curves with dotted lines, each designated by the letter A. These were made by a domestic Portland. In the first curve the cement was immediately placed in the mold, in the second it was delayed for a period of 8 hours in the mixing bed. It will be observed that the maximum temperature attained by the first cube occurred about the time the material of the second reached the mold. The maximum temperature of the latter was reached four hours later, or 12 hours after gauging.

Mortars do not attain so high temperatures as neat cements. The curve of a mortar which was made of equal parts of cement and sand is shown by the line marked 1:1 of the diagram. The maximum temperature was 55° Cent., but this was not attained until 18 hours after gauging. With leaner mortars lower temperatures prevail. Cements gauged with hot water reach higher temperatures and attain the maximum sooner than when cold water is used. Gauging with larger quantities of water is attended with lower results, and prolongs the period of ascending temperatures. A rapid rise may frequently be noticed when limited quantities of water are added to a small batch of cement, using from 5 to 10 per cent. of water.

The natural cements as a class do not reach so high temperatures as the Portlands. An ordinary maximum for this class is 40° Cent.

During the stage of ascending temperatures, chemical reactions are necessarily in an active state, and it would seem that final set could not properly be said to have occurred while this was going on. If such is the case, the mortar cube just mentioned did not reach a state of final set until at least 18 hours had elapsed. The subject of setting is again referred to since evidence presents itself from several sources tending to support remarks previously made.

Effect of Low Temperatures.—The compressive strength after exposure to low temperatures while setting was made the subject of inquiry. Sufficient material was mixed at each batch to furnish duplicate lots of 2-in. cubes, one lot being allowed to set in air at the temperature of the room, about 70° Fahr., the other lot being immediately frozen and kept at zero Fahr. until the day before testing. There were other batches of which one lot was kept at 70° as before, while the duplicates were kept at a temperature a few degrees above freezing. The facilities of a cold storage warehouse were availed of for the purpose of keeping the samples at the desired temperatures.

The diagram shows the character of the results. The upper curve represents the strength of a neat cement which set in air in the vicinity of 70° Fahr. The middle curve shows material of the same batch which was frozen at once upon gauging, and kept thereafter at zero temperature until the day preceding the test, the last day being in air at 70°.

The lower curve of the diagram shows the strength of a mortar composed of one part cement and one part sand.

From the middle and lower curves a number of dotted lines branch upward. These lines represent the strength of zero samples after a subsequent exposure in air at 70°.

The period during which the cement was maintained at zero temperature was one of greatly retarded action, but not apparently one of complete suspension, in respect to the acquisition of strength. Cubes which remained in the freezer three months showed a gain over those which were tested at the end of one month or shorter intervals, while those a year old showed a further gain in strength.

When the zero samples were brought into the air at 70° there was an immediate acceleration in the rate with which they gained strength. Exposure of one week in an atmosphere of 70° following an interval of one or three months at zero temperature was attended by a gain in strength corresponding closely with that which would be expected during the first week after gauging under the usual conditions of setting. The useful property of acquiring compressive strength was not destroyed during the time the specimens were held at zero Fahr. covered by these experiments, nor was it impaired to any considerable degree. Natural cements and Portlands alike gain rapidly in strength when raised to a temperature of 70° from an initial period of zero.

Exposure to a temperature a few degrees above freezing generally had an intermediate effect between the zero and the 70° specimens, although there were some which, setting at 39° Fahr. had substantially the same strength as those which set at 70°. In other cases where a partial suspension of activity occurred, the period of subsequent exposure at 70° was characterized by a rapid gain in strength which occasionally surpassed that of samples which set at 70° during their entire time of aging.

Respecting the query, what age should precede the frozen interval in order to avoid temporary arrest in the acquisition of strength, the tests showed that one day at 70° Fahr. was not a sufficient length of time for the purpose. After an initial period of four days at 70° one brand displayed about normal strength. With other brands an initial period of seven days was insufficient to escape the retarding influence of subsequent exposure to zero temperature.

Effect of High Temperature.—The effect of exposure of cement to moderately high temperatures was observed. In these tests care was taken to avoid sudden changes in temperature. It was desired to ascertain the effect of elevation of temperature alone without introducing internal strains incident to a state of unequal temperatures in different parts of the specimen. The disrupted sample of neat cement here exhibited [the speaker here showed an exhibit] is the result of exposure to a temperature of 1,000° Fahr. This cube set in air one year and three months before being heated. Its loss in weight when heated was 11.1 per cent.

The cracks, now so wide and numerous, were hardly visible immediately after heating and cooling, nor were they so one day later. Four days after heating they were generally developed, and eleven days later the cube reached about its present appearance. The effect on the crushing strength is not serious when the cracks are only slightly opened. The several parts, of course, fit well together while in that condition, and until there is a change in the shape of the fragments the compressive strength is not seriously impaired. A temperature below that at which this cube was heated is adequate to cause the ultimate appearance of cracks; 900° Fahr. and lower has caused cracks.

Setting under High Pressure.—Increasing the density of the gauged cement in the cake acts favorably upon its compressive strength. This may be accomplished by setting initially under high pressures. A number of specimens were prepared in which the gauged cement was put into a stout cylinder and immediately loaded with pressures ranging from 7,000 to 14,000 lbs. per sq. in., which pressures were allowed to remain acting 40 or more hours.

These specimens developed phenomenal strength when tested at the age of one and two months. A sample of neat cement one month old had a compressive strength of 19,120 lbs. per sq. in., and a 1 and 1 mortar a strength of 14,000 lbs. per sq. in. Another neat example showed a compressive strength of 22,053 lbs. per sq. in. at the age of 57 days, the highest strength yet observed.

Setting under high pressures admits of the use of smaller quantities of water in gauging than usually employed. Five per cent. of water, by weight, was used in gauging the sample here exhibited. [The speaker here showed a sample cube.] A weight of 160.7 lbs. per cubic foot was reached in one of the samples of neat cement belonging to this series.

The maximum value of the modulus of elasticity observed in cement was also found in a sample set initially under high pressure, the value being 5,854,000 lbs. per sq. in.

Rigidity of Constructive Materials.—The smaller diagram here presented [this is not reproduced] was prepared to exhibit the relative rigidity of constructive materials and shows the position occupied by Portland cement with reference to other materials commonly used. The modulus of elasticity here indicated is an average value for cement which has set in the ordinary manner, without initial pressure.

Cement is capable of enduring enormous loads, without apparent injury, when subjected to cubic compression; that is, when the several sides of the specimen are simultaneously loaded. Two cubes are exhibited [the speaker here called attention to samples] from a batch of cement which was held in the mixing bed for a period of 102 hours before tamping into the molds. One was placed in a cylinder surrounded by water and exposed to a pressure of 30,000 lbs. per sq. in. It was encased in a thin, brass envelope which prevented the entrance of water to the material. This cube is strong, seemingly, comparing well with its companion which has not been loaded. It has been permanently compressed about 9 per cent. in linear dimensions, in volume reduced 25.8 per cent. The display of such properties is certainly unusual by material of this class. This result was made possible by reason of its primitive state of porosity, which in turn was due to its treatment in the mixing bed. Before compressing, it weighed about 83 lbs. per cu. ft., and after compressing 112 lbs. per cu. ft.

Cement in a state of greater density is but slightly compressed, even by higher loads. This small cylinder [referring to exhibit] has been exposed to a load of cubic compression of 100,000 lbs. per sq. in. It was reduced 0.01 in. in diameter and length each. This was taken from a part of the cylindrical sample previously exhibited, which was gauged with 5 per cent. of water and set under high initial pressure, and encased in thin brass in the same manner as the cube last described.

A sample of limestone was similarly loaded with 30,000 lbs. per sq. in., and afterward tested by compression in the ordinary manner. Its normal crushing strength remained unimpaired at 11,000 lbs. per sq. in. These results are consistent with what occurs in nature, since deeply buried rocks are subjected to compressive stresses, in confined positions, in excess of their strength as we are accustomed to determine it.

Samples of cement not encased permit the water to pass through them without change in size. Previous tests have illustrated the fact that the physical properties of metals are not changed by exposure to cubic compression loads in excess of both their elastic limits and tensile strengths.

Columns.—The Arsenal tests on cements and concretes have now reached that state in which attention centers upon the results obtained with full-sized columns. Plain and re-enforced columns, 12 in. square by 8 ft. high, of different compositions and different methods of re-enforcement are comprised in the series. Including a number of brick piers about 100 columns have already been made and many of the number are tested. The diagram shows the relative compressive strength of a few representative columns.

The longest line across the diagram represents a mortar column composed of equal parts, by volume, of cement and sand. The length of this line corresponds to the maximum load which was applied, but in this case it does not show the ultimate strength. The column, at the age of six months, sustained the full load of the testing machine, 800,000 lbs., without failure. The other lines of the diagram represent breaking loads. Three lines represent columns which were re-enforced with longitudinal steel bars, extending from end to end of their respective columns, 8 bars being used in each. One of these columns reached a compressive strength of 3,160 lbs. per sq. in, the highest of the re-enforced columns yet tested. This had 4.5 sq. in. of re-enforced metal, or about 3 per cent. of the sectional area of the column. The bars were without lateral ties, the supporting power of the concrete being relied upon to prevent buckling. It is not unusual to reach a compressive stress of 50,000 lbs. per sq. in. on re-enforcing bars, which are merely embedded in the concrete without other means of lateral support.

Respecting the cost of the materials for a column of high strength, the cost of the cement used in the 1 and 1 mortar column compared with that of the re-enforcing bars in the column just referred to, considering at the same time the strength obtained in the two instances, makes a showing favorable for the mortar column.

The lower two lines of the diagram are shown in full for parts only of their lengths. This is to indicate that they were loaded on two different occasions. Each was loaded when seven days old, and again when four months old. It was evident from the behavior of the column without re-enforcing bars, that its maximum strength was reached at 471 lbs. per sq. in., in the seven days' test. The test was discontinued after applying this load, the column remaining without load until the test was resumed at the age of four months. Its strength was then found to have reached 1,350 lbs. per sq. in.

The re-enforced column was similarly treated. It was loaded with 1,200 lbs. per sq. in. in the seven-day test, but its strength was not then reached. At the age of four months it had a compressive strength of 2,650 lbs. per sq. in.

Two features of interest are found in these tests. Overloading, even to the limit of its strength, did not destroy the ability of the plain column to gain upon further aging, and eventually require a load of more than 2½ times its earlier strength to finally crush it. This result is reassuring as to the effect of early loads upon the compression members of concrete structures.

In the test of the re-enforced column, the immediate availability of the steel bars to sustain their loads at a time before the concrete has acquired much strength is emphasized.

The lugubrious border of this diagram is not intended as a mourning emblem. It chanced that the aggregate length of the four sides represent, on the same scale with which the other lines are drawn, the strength of a sample of neat cement which was set under high initial pressure. The possibilities of cements may be judged by the length of this border; the fractional parts generally made use of, by the lengths of the several horizontal lines.

In conclusion, it must be admitted that the phrase "armored concrete" is a very attractive one when employed to suggest the advantages of metal re-enforcement, but the results of tests indicate that the strength of the composition rests largely in the cement, and considering the means by which high ultimate strength may be obtained at a given cost, it appears from present data that the cheapest and best re-enforcing material for compression members is neat Portland cement.

Concrete in Railway Construction.

Some interesting data concerning present views of railway engineers respecting the use of concrete for certain classes of work are contained in the report of the Committee on Masonry of the American Railway Engineering & Maintenance of Way Association, presented at the last convention. The information was collected by circulars, which were fully answered by many of the companies receiving them.

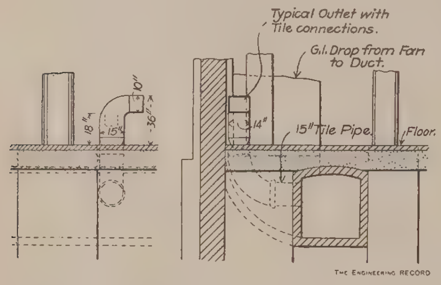
With respect to the efficiency of concrete back for stone face work, the opinion seems to be that as a combination structure is more expensive than a straight concrete structure, it is desirable to combine the two only under certain conditions. Where sufficient care is taken, no difficulty is experienced in securing a satisfactory bond between a stone face and a concrete back. The best result is obtained from a wet concrete. As this is not a form of construction to be adopted because it is superior in any way to either stone or concrete masonry, but is a form which may be desirable and successfully applied under certain conditions, the committee recommends that in this form of construction the face work be constructed after the usual manner, the back being left as rough as possible. To make the bond between the face and back more certain, headers should project well into the concrete. The work should be constructed in courses, and the backing brought up flush with each course of face stone.

Imbedding large stones in concrete is not a very common practice among railway engineers, because conditions seldom exist that favor, from an economical standpoint, this form of construction. The feeling seems to be that in massive work, where weight is more of a factor than strength, rubble concrete can safely be used; therefore, in such work the question would resolve itself into one of comparative cost. Apparently one point of weakness in this form of construction is the fact that it is difficult to place the rubble stone so that the joints will be broken. Wet concrete is favored for this form of construction, as it is easier to force it to conform to the outline of the rubble stone, and a more perfect bond between the two materials is obtained. That the rubble stone should be placed a sufficient distance apart to permit perfect tamping of the concrete seems to be an important factor. The relative size of the rubble stone to the thickness of the wall is a point that should receive serious consideration.

The committee recommends the use of rubble concrete wherever a saving would result, provided the wall or structure in question is not less than 4 ft. thick. The greatest diameter of the rubble stone must not exceed one-half the thickness of the wall or structure. The rubble stone should be drenched, before placing, and care must be exercised to avoid continuous vertical joints. The concrete must be sufficiently wet to conform readily to the rough surface of the rubble stone, but not so wet as to permit the segregation of the rubble stones. The thickness of the concrete between the rubble stone and the exterior of the wall must not be less than one foot. The rubble stones should be placed on their natural bed, and the minimum distance between them must not be less than 6 in.

Concrete is being used extensively and successfully under bridge seats, there not being a single case reported where concrete bridge seats failed to do the work expected of them. Concrete seats have been successfully used in bridges up to 200-ft. span, and are successfully constructed from the same grade of concrete as used in the pier or abutment, except that a smooth finish is obtained by the use of a cement and sand mortar on the top.

The committee recommends the use of concrete bridge seats under all ordinary conditions where the body of the pier or abutment is constructed of concrete, using a slightly richer mixture in the coping than in the body of the structure. The work should be continuous, no time intervening between finishing the body of the structure and placing the seat. The bridge seat should be finished on the top with a mortar composed of one part Portland cement and two parts sharp sand and troweled smooth. This top finish should never be less than one inch thick.


Typical Outlet with Tile connections.
G.I. Drop from Fan to Duct.
10"
18"
15"
36"
14"
15" Tile Pipe.
Floor.
The Engineering Record

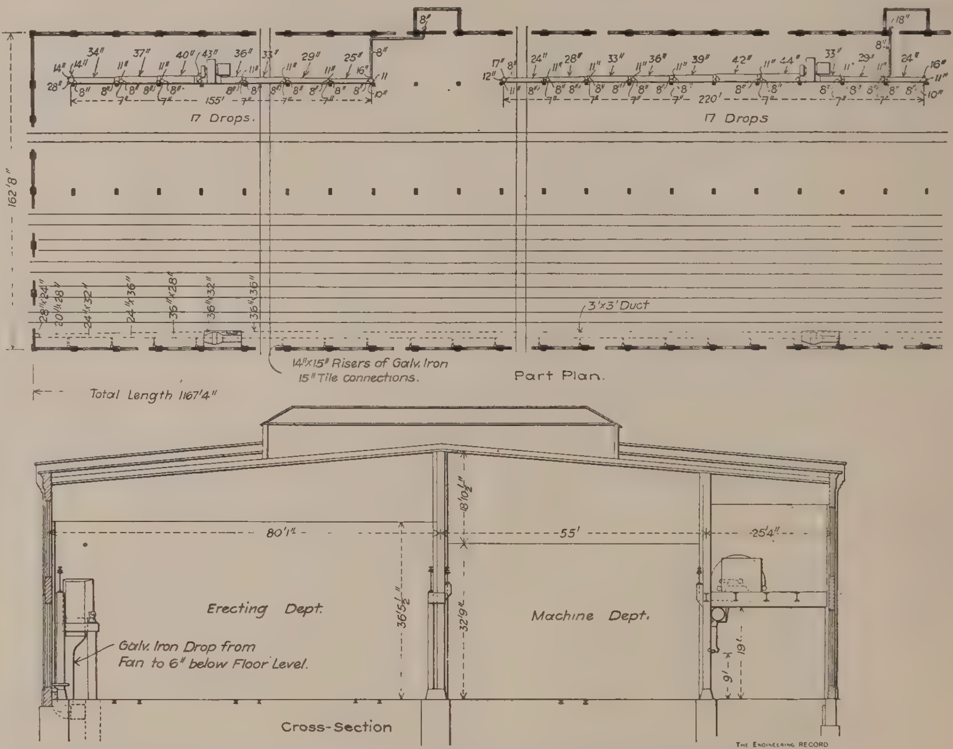
Details of Hot Blast Duct and Outlet Connections.

Reinforced concrete for small openings is considered by the committee to have many points of advantage to its credit, among them, ease of construction, low first cost and durability. The value of the concrete arch constructed of plain or reinforced concrete is well known, and is usually preferred wherever the conditions will permit of its use. The use of the flat-top structure is more limited than that of the arch, but because of the economy with which it may be constructed and the limited head room required, the committee considers it a form with great possibilities. There are certain forms of I-beam construction in which the I-beams carry the load and the concrete protects the metal from corrosion, that should not be classed as reinforced concrete. Such construction, although very effectual, consumes a large surplus of metal, and therefore is not economical. There is little room for doubt as to the question of economy of straight reinforced concrete structures compared with the common form of construction for small openings. The committee thinks it advisable to substitute reinforced concrete for the common forms of construction for small openings.

Heating System of the Canadian Pacific Ry. Shops at Montreal.

The design of heating plants for the buildings of the new Angus shops of the Canadian Pacific Railway Co., at Montreal, Canada, involved interesting problems not only on account of the cold winter weather in the latitude of Montreal, but also because of the immense sizes of the structures. The magnitude of the problem is evident from the fact that the combined cubical contents of the buildings heated amounts to over 28,000,000 cu. ft., which has to be kept at temperatures of 60° to 70°, with the outside temperature of 10° below zero. The large areas of windows and skylighting used in all of the buildings also added to the severity of the conditions, the extent of skylighting approximating 25 per cent. of the area of the roofs, while the side window areas amount to nearly half that of the side walls.

This establishment is one of the largest railway shops in existence, and was described in detail in The Engineering Record of March 19 and 26, and April 2, 1904. It provides for the greater part of the maintenance and car and locomotive building work for a railroad system embracing over 8,000 miles of track, and also a large amount of manufacturing, including the making of chilled iron wheels. All the maintenance and repair work upon the 500 locomotives of the Eastern divisions will be done here, as well as the heavy overhauling repairs of 60 to 100 locomotives per year for the Western divisions, and the building of about 50 new locomotives, 100 new passenger cars, and upwards of 10,000 new freight cars per year. There are over twenty shop buildings, the 162x1,166-ft. locomotive machine and erecting shop building being the largest, and nearly 30 miles of shop tracks and sidings are required to serve the various departments.

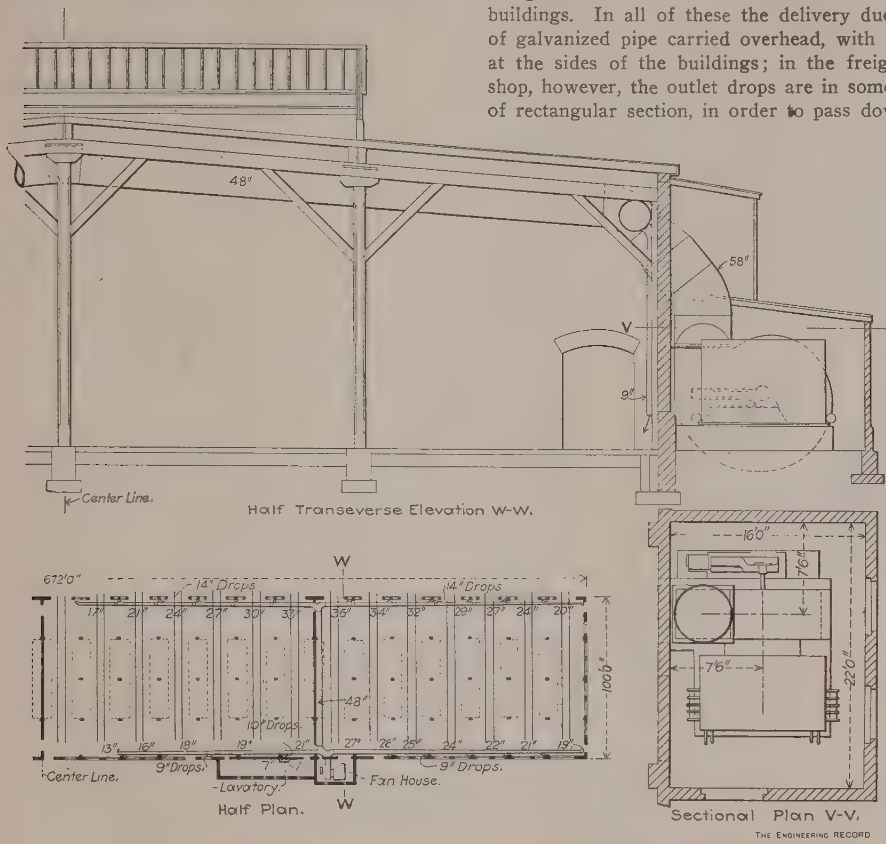


Details of Heating Apparatus in the Large Locomotive Erecting and Machine Shop.

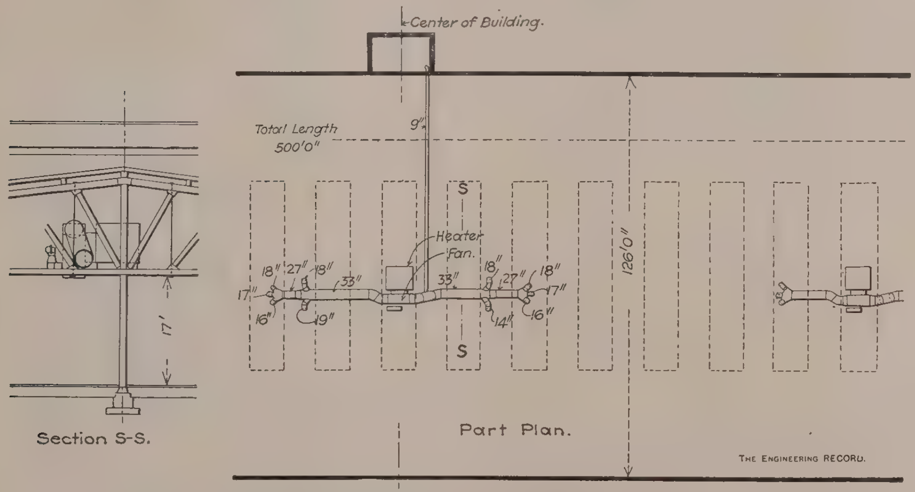
The heating equipments are of the hot-blast type in all of the buildings, the apparatus for which was designed and installed by the B. F. Sturtevant Co. Various methods of using the type have been worked out to satisfy the different requirements of the buildings, including delivery through underground brick ducts with short outlet risers through the floor, and overhead galvanized-iron ducts with drop outlets along the side walls or at posts, so as to blow from the center towards the walls, from one wall towards the other, etc. Obstacles were encountered in some instances, such as limited space in which to locate the apparatus, the necessity of avoiding cranes and shavings exhaust systems and forge blast and exhaust systems. In most buildings unfavorable conditions were introduced by the large track doors. In the majority of the heating equipments outside fresh air connections are made, so that either the air in the building may be used over and over again or fresh air may be introduced into the blast system for purposes of ventilation, as desired. In such buildings, however, as the foundry, frog and blacksmith shops, and the planing mill, where exhauster systems are in use, no outside air connections are made, it being expected that the natural window and door leakage and the effect of the exhauster connections will provide all necessary ventilation.

Probably the most difficult heating installation was that in the locomotive machine and erecting shop building, described in this journal on March 26, 1904. Five independent heating equipments were installed on each side of this building. Those on the erecting side are mounted on narrow platforms next to the outside wall, 15 ft. above the floor, and blow downward into a common 3x3-ft. brick duct beneath the shop floor. The delivery outlets consist of 15-in. risers about 2-ft. high, which connect into the side of the underground duct every 22 ft. Each outlet comes through the floor close to the side wall to afford the maximum clearance, and has openings delivering both along the wall and across the shop. Each of the five fans in the machine department is located in a gallery which extends throughout the outer side of this section, the delivery being through galvanized-iron pipes hung beneath the gallery floor. Each equipment on this side operates independently and discharges through a trunk duct from 110 to 220 ft. long, with four-mouthed outlets dropping alongside every gallery post. All of the heater units in this building consist of 7x4-ft. fans, with three-quarter housings, blowing through heating coils, and driven by 7x10½-in. simple horizontal side-crank engines. Those on the erecting department side were especially designed to come within narrow limits, and thus present as little interference with the crane and track operations as possible. The temperature guarantee for this building calls for 60° in the east end of the interior and 50° in the west end, with the outside extreme of 10° below zero.

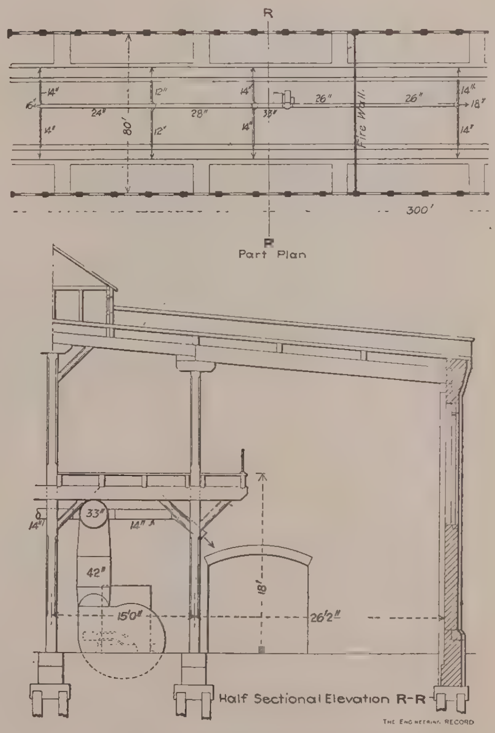
The arrangement of the heating apparatus in the passenger car erecting shop (Engineering Record, April 2, 1904), as shown in an accompanying drawing, is typical of a number of the larger shop buildings of the plant. It consists, in brief, of a hot-blast equipment located in a small lean-to building outside of the main shop, from which trunk delivery ducts lead to the outlet openings along each side of the building. In both the passenger car erecting and passenger car paint shops, which are similar in construction, each 672x100 ft. in size, with interior heights of 25 ft., the delivery ducts are of galvanized-iron pipe, and are carried along the roof beams to the outlet points between each of the large doors or windows; the outlet drops, which vary in diameter from 9 to 20 in., drop to within 4 or 5 ft. of the floor, and blow directly toward it. In the passenger car paint shop there are, in addition, small outlets blowing across the shop. Each of these buildings, which is divided into two sections, has two hot-blast outfits, consisting of 8½x4-ft. three-quarter housing fans, driven by 8x12-in. horizontal engines. These equipments are designed to heat their buildings to 70° if desired.



Arrangement of Heating Apparatus and Ducts in the Passenger Car Erecting Shop.



The Elevated Arrangement of Hot Blast Apparatus in the Planing Mill.



The Heating Equipment of the Storehouse.

The heating systems are similarly arranged in the freight car shop, the car machine shop and the truck shop, the blowers, engines and heating coils being located in lean-to sheds outside the main buildings. In all of these the delivery ducts are of galvanized pipe carried overhead, with outlets at the sides of the buildings; in the freight car shop, however, the outlet drops are in some parts of rectangular section, in order to pass down between the wall and the craneway. These three shops all have heaters designed to maintain the interior temperature at 60°.

The heating equipment of the planing mill, a 500x125-ft. building, is interesting in that the hot-blast outfits are located on elevated platforms, which are carried by the roof trusses, as indicated in the cross section of this shop. In this way no portion of the heaters or fans project below the lower chords of the roof trusses, giving thus free headroom in the shop. There are three 6x3½-ft. blowers in this building, each of which has a double discharge into trunk ducts about 80 ft. long running through the center of the shop. The outlet openings are arranged to blow horizontally toward the walls. The installation of the duct systems in this building was rendered more than usually difficult by the presence of the shavings exhaust system used with the woodworking machinery; the exhaust pipes in this building and those in the frog and blacksmith shops had to be avoided. In the last-mentioned shops there were three different pipe systems encountered for forge blast and exhaust and for furnace blast.

An example of a heater application to one of the smaller buildings is to be noted in the 300x80-ft. general stores building, which has an average inside height of 32 ft. Running throughout the center of this building there is a storage platform or gallery 40 ft. wide, 18 ft. above the floor, and beneath this are located the hot-blast equipments, each consisting of a 5½x3-ft. blower operated by a 6x6-in. side-crank steam engine. The air distribution is through main galvanized-iron ducts running longitudinally underneath the gallery, from which branches extend toward the edge with their outlets pointing downwards and toward the walls.

The heater coils of the hot-blast equipments are in each case connected so as to use either exhaust or live steam as desired. They are operated in general, however, with the exhaust from their blower engines, supplemented by that from the power plant engines; the latter will be sufficient in moderate weather, but inadequate in very cold weather periods. The condensation from the heating coils drains to small vacuum return pumps, which discharge through a general return main to the central power plant. The heating coils are all built with vertical coils of 1-in. pipe, with cast-iron bases, the amount of pipe per base varying from 450 to 1,100 ft. An elaborate system of underground tunnel pipe distribution (see Engineering Record, March 19, 1905), is in use for carrying the steam and exhaust pipes to the various heater equipments, the longest distribution from the power plant being nearly 3,000 ft. The blower installations are large enough to completely recirculate all the air in any building three times per hour.

Sewage Discharge into New York Bay.

Two years ago the Governor of New York appointed a commission to investigate the existing and prospective pollution of New York Harbor by sewage. In 1833 the States of New York and New Jersey, with the approval of Congress, entered into an agreement by which the former was given full sanitary control over the waters of the harbor. Of late the amount of sewage reaching the harbor has been increasing rapidly, and the proposal to discharge into it the entire sewage of the Passaic valley aroused such a fear of unsanitary results that the commission mentioned was appointed. Its members were Dr. Daniel Lewis, health commissioner of the State; Prof. Olin H. Landreth, consulting engineer of the State Department of Health; Dr. George A. Soper, Prof. Myron S. Falk and Mr. L. L. Tribus, commissioner of public works of the Borough of Richmond. Their report has just appeared, and is such an interesting discussion of a sewage disposal problem of enormous magnitude that a full abstract of it is here presented.

Tidal Conditions.—Assuming that the Passaic Valley trunk sewer has been constructed with one, two or three outlets north of Robbin's Reef Light, the action of the tidal currents would very largely determine the question whether or not the sewage discharge would be likely to become offensive. If the sewage should be discharged at a uniform rate throughout 24 hours, it is unquestionable that some of it would be carried northwards into the Hudson and East Rivers and southward to the shores of Staten Island, according to the tides. If the sewage should be retained so as to have the outflow only on the ebb tide the percentage reaching the shores of Staten Island would be greatly increased.

A matter of much importance is the underrun of salt water beneath the fresher waters from the Hudson. The difference in specific gravity between them may be as high as 2½ per cent. There is thus an obvious tendency for the salt water to force itself up the river for a considerable distance and to remain stagnant while the fresher waters flow seaward. It does not seem improbable, therefore, that some of the sewage discharged at from 30 to 40 ft. beneath the surface would encounter strong up stream currents and be carried some distance up the Hudson River. This might largely vitiate the efforts to dispose of sewage from the proposed Passaic Valley trunk system by tidal carriage and diffusion. The subject is one more largely of tidal phenomena than straight diffusion, except as to the great probability of a local nuisance being created near the outlet pipes.

It has been practically impossible to secure exact figures as to the tidal flow phenomena, though United States Government engineers some years ago conducted a series of observations and tests. From them and other data it seems probable that a quantity of water not far from 12 to 13 billion cubic feet enters the upper bay at each of the tides per day. Of this amount, the approximate figures may perhaps be: 4,250 million cubic feet into the East River; 6,750 million cubic feet into the Hudson River; 1,750 million cubic feet into the Kill von Kull. The areas of the tidal basins receiving this flow are approximately as follows: Kill von Kull, Newark Bay and the Passaic and Hackensack Rivers about 14.2 square miles, the upper bay about 21.5 square miles, the East River about 4.5 square miles, while the Hudson River has a tidal area equal probably to all the others combined.

The Government reports give the maximum ebb velocity of the current in the Narrows at 1.5 knots and the maximum flood 1.2 knots per hour. In the Hudson River off 39th St. these figures are respectively 2.7 and 2.0 knots, and in the East River off 23rd St., 2.0 and 1.8 knots. Estimating a constant velocity of discharge during the various tidal periods of the day the average ebb velocity at the Narrows would reduce to 1.61 miles per hour, the average flood velocity 1.48 miles per hour.

It is probable that most of the sewage which reaches the radius of action of the active tidal ebb flow will ultimately be carried out of the harbor to the ocean, though taking several days in the process, but it is not so evident that all of the sewage, or even the major part of it, will reach such radius of action, and hence will remain in the harbor for gradual putrefaction and breaking up.

Pollution of Bay.—Without elaborate study, no one can estimate with precision the exact degree of pollution permissible, before the conditions will reach a serious stage. The accompanying table gives estimates of the present normal daily sewage flow from existing sewers; that proposed from the Passaic Valley trunk sewer and that from another large system lately constructed, which will accommodate South Orange and other communities in that portion of New Jersey, as well as a considerable portion of the city of Elizabeth.

ESTIMATED VOLUME OF SEWAGE REACHING THE HARBOR DAILY IN DRY WEATHER.

Locality.	Population.	Daily dry weather sewage, gals.
Communities on shores of New York harbor	4,470,000	447,000,000
Part of Elizabeth and South Orange district	80,000	8,000,000
Part of Passaic Valley district..	500,000	50,000,000
Totals	5,050,000	505,000,000

On the map accompanying this report has been indicated by small circles the outlet points of all sewers of which information could be secured. Most of these accommodate storm flow as well as sanitary sewage. Immediately following rain storms a great deal of filth from the streets reaches the harbor through them. The dilution at such times becomes so great, however, from the storm flow itself that little additional cause of trouble need be attributed to this feature of the case, though in quantity it would probably average some 350 million gallons per day.

The saving feature of the present discharge is that it debouches at so many different points that very thorough dilution occurs and any great localized nuisance is avoided. This condition could not be predicted if the whole flow should be gathered into five or six outlets, each having the capacity of the proposed Passaic Valley trunk sewer. It must be borne in mind in considering all such matters as those made the subject of this report, that the best or even average conditions are not those which govern the case, but that the worst possible conditions which may arise are those which should determine conclusions.

Effect of Pollution.—From the studies of the Commission it is evident that the present pollution of New York Bay, although not great, is distinctly measureable by chemical and bacteriological analyses, and careful studies of the relative proportions of sea and fresh waters in the bay and rivers about New York show that the sewage of New York City is not promptly flushed out to sea, except during heavy freshets from the Hudson. The water of the incoming tide is not ordinarily much purer than the water of the outgoing tide, as noted in the Upper Bay, and it is probable that most of the sewage now entering the harbor is disposed of in the harbor itself by the lower orders of animal and plant life found abundantly in the waters.

The oyster beds of New York Bay are almost exclusively found on the southeast side of Staten Island and in Gravesend Bay. Most of these shellfish beds are now free from dangerous pollution, though some of them are found to be nearer sewer outfalls than is wise or proper. Analyses of oysters and clams made under the direction of the Commission show that shellfish grown or immersed for some hours in polluted water become polluted themselves. This fact is of peculiar importance, for the custom is almost a universal one of taking oysters from their natural beds and depositing them for a few hours or days in the mouths of fresh water streams adjoining the coast (streams which are almost invariably seriously polluted), the object being to give the oysters a so-called "drink," which results in bleaching and bloating them.

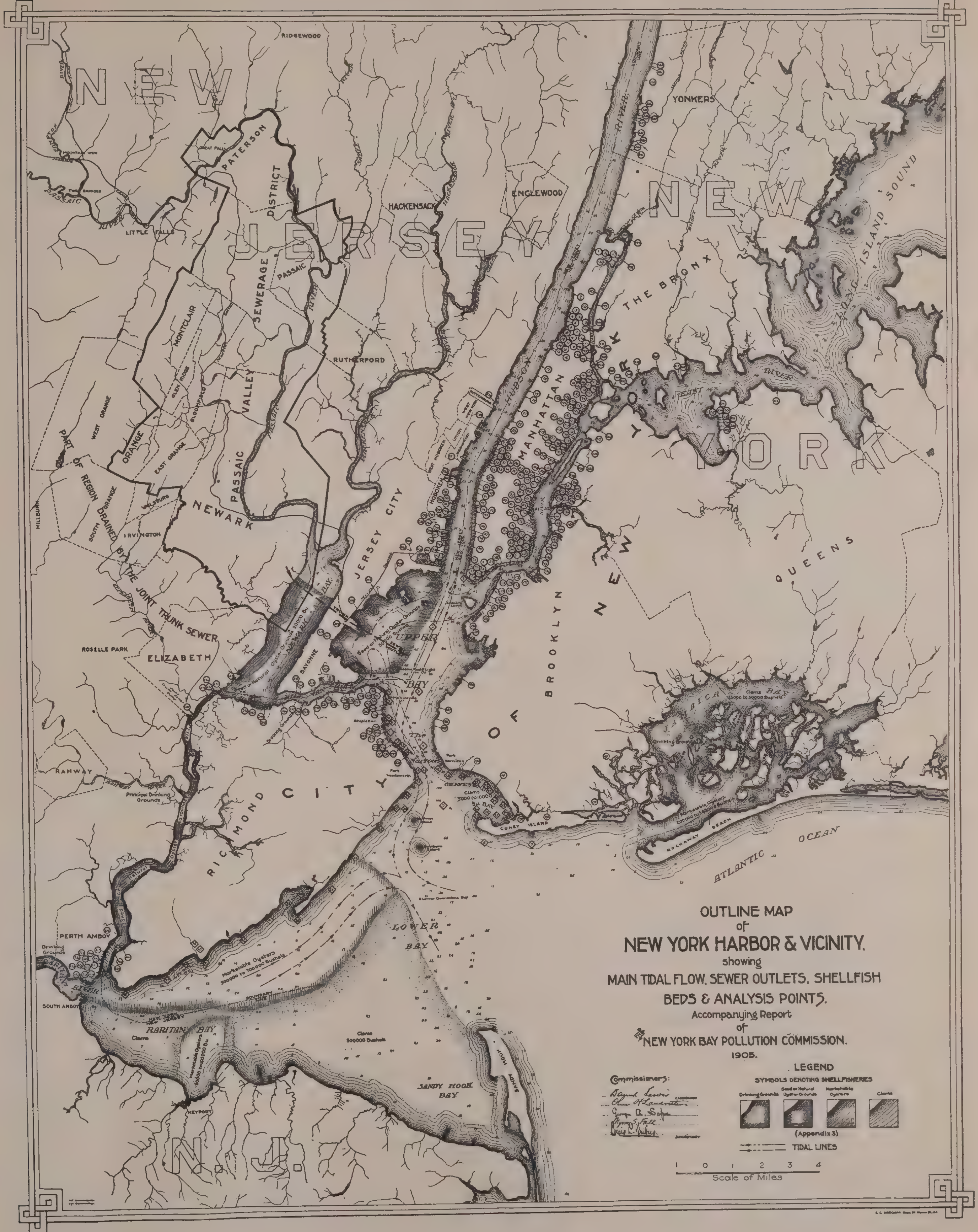
Fish caught in the harbor do not seem to have given evidence of impairment of their meat due to polluting matters, except at certain times in the past from special causes, such as the outpouring of petroleum and other industrial wastes.

Chemical examination of the waters made by this Commission and by others show distinct evidence of pollution, both at ebb and flood tides, particularly in the Upper Bay, though the examinations do not warrant the opinion that the water is everywhere and at all times badly contaminated, but that traces of pollution can be found after the sewage has been thoroughly commingled with the waters of the bay and has traveled miles from its point of origin. The Commission does not desire, however, to base too great importance on the analyses taken through any one year. Such analyses are rather indicative of lines of investigation than conclusive in themselves, unless the results of several consecutive years have been secured and confirmatory evidence accumulated.

The nearest precedent to the construction of such a sewer as is proposed for the Passaic Valley, and the discharge of sewage at either one or several points near together, is from the system of the city of Boston and Metropolitan districts adjoining, where a discharge at Deer Island in Boston Harbor of about 40,000,000 gal. of sewage per day causes the waters about the outlet to be discolored over an area of approximately three-quarters of a square mile. At Moon Island, in Boston Harbor, a discharge of about 22,000,000 gal. of sewage in less than one hour coming from tidal detention basins discolors abut 1¾ square miles, fully two-thirds of this area being offensive to both sight and smell. It seems possible that the sewage from the proposed outfall of the Passaic Valley trunk sewer would discolor and render more or less offensive well towards 5 square miles of the most beautiful and most traveled part of New York Bay, assuredly covering the water, on calm days, at least, with a thin film of grease, which would probably extend to Liberty, Ellis and Governor's Islands and at times even as far as the Battery, Brooklyn and nearly the whole of the north and easterly shores of Staten Island.

On March 6, 1905, the Court of Errors and Appeals of the State of New Jersey declared unconstitutional the act of 1903, under which the Passaic Valley District Sewerage Commission proposed to construct its great trunk system and empty the sewage into New York Bay; ten judges being in favor of reversing the Supreme Court, which had declared the act constitutional, and but one judge upholding the court. The fatal defect was held to be the method provided for levying taxes to meet the cost of construction and maintenance. Consequently, the immediate threatened danger from the special sewerage system, which caused the appointment of this commission, is delayed by this decision of the New Jersey Judiciary. Undoubtedly, however, there will be renewed attempts to pass an act which will avoid the defects of the former ones, so that New York State should continue to take cognizance of this question, and the greater one of general pollution of the harbor as well.

Possible Ocean Disposal.—The Commission's investigations lead toward the belief that the limit of the possible pollution of the harbor water with-


OUTLINE MAP
of
NEW YORK HARBOR & VICINITY,
showing
MAIN TIDAL FLOW, SEWER OUTLETS, SHELLFISH
BEDS & ANALYSIS POINTS.
Accompanying Report
of
NEW YORK BAY POLLUTION COMMISSION.
1905.
LEGEND
SYMBOLS DENOTING SHELLFISHERIES
Drinking Grounds
Seed or Natural Oyster Grounds
Marketable Oysters
Clams
(Appendix 3)
TIDAL LINES
1 0 1 2 3 4
Scale of Miles
Commissioners:
Chairman
Secretary
NEW JERSEY
NEW YORK
N. J.
RIDGEWOOD
YONKERS
PATERSON
GREAT FALLS
MOUNTAIN VIEW
TWO BRIDGES
PASSAIC RIVER
LITTLE FALLS
PASSAIC VALLEY SEWERAGE DISTRICT
HACKENSACK
ENGLEWOOD
PASSAIC
MONTCLAIR
GLEN RIDGE
BLOOMFIELD
WEST ORANGE
ORANGE
EAST ORANGE
RUTHERFORD
PASSAIC RIVER
HACKENSACK RIVER
HUDSON RIVER
THE BRONX
LONG ISLAND SOUND
EAST RIVER
MANHATTAN
HOBOKEN
WEST HOBOKEN
UNION
PART OF REGION DRAINED BY THE JOINT TRUNK SEWER
SOUTH ORANGE
MILLBURN
VAILSBURG
IRVINGTON
NEWARK
JERSEY CITY
NEWARK BAY
Seed or Natural Oyster Grounds 20000 Bu.
BAYONNE
Seed or Natural Oyster Grounds 30000 Bushels
UPPER BAY
BROOKLYN
QUEENS
ROSELLE PARK
ELIZABETH
RAHWAY
Principal Drinking Grounds
Drinking Grounds
Stapleton
The Narrows
Fort Hamilton
Fort Wadsworth
GRAVESEND BAY
Clams 3000 to 10000 Bu.
CONEY ISLAND
JAMAICA BAY
Clams 25000 to 50000 Bushels
Drinking Grounds
ROCKAWAY BEACH
ATLANTIC OCEAN
RICHMOND CITY
LOWER BAY
PERTH AMBOY
Drinking Grounds
SOUTH AMBOY
RARITAN RIVER
Marketable Oysters 350000 to 700000 Bushels
RARITAN BAY
Clams
Clams 500000 Bushels
Marketable Oysters 50000 to 100000 Bu.
KEYPORT
SANDY HOOK BAY
SANDY HOOK

out creating a very offensive nuisance has nearly been reached. But two real systems of disposal are open to the district as a whole. One is the construction of sewage disposal plants for each local district or municipality within its own boundaries, which would so treat the sewage as to make the effluent inoffensive when it reaches the waters of the harbor. The other plan is some comprehensive scheme for ocean disposal of the crude sewage from the whole metropolitan district lying in New York and New Jersey, either by one or by several great trunk sewers or tunnels. A work of such magnitude can only be suggested at this time in the barest outline, as studies and plans would need to be exceedingly exhaustive and in great detail in order to properly conserve the sanitary and financial interests of the districts affected.

In general the conclusions of the Commission would seem to be that owing to the nature of the development of New York City and its environs, the first plan of separate utilization plants would be practically impossible of execution. Therefore, the other plan of ultimate ocean disposal seems to offer the most promising possible solution of the whole question, and one worthy of the fullest and most thorough investigation and development.

The Commission, from the very inception of its investigations, has been confronted with the fact that the construction of the proposed Passaic Valley sewer is only one of many similar problems demanding legislative action for the protection of the waters of New York Bay against sewage contamination. The contention of the New Jersey Commission, that because the bay is now more or less directly receiving raw sewage from 4,000,000 people, therefore an increase from 1,000,000 more should be permitted, is untenable.

The establishment of a metropolitan sewerage district has been suggested, to include all sections in both New York State and New Jersey which now or in future might sewer into the bay and its tributaries. Such a district, when authorized by joint State and Federal legislation, should be under the direction and control of a permanent interstate commission, with plenary power to control the discharge of all sewers hereafter constructed, as well as the evolving of a comprehensive plan for ultimately rendering the present chaotic and systemless method of sewage disposal, sanitary and suitable for all future requirements.

Recommendations.—Based upon the Commission's own researches during the past eighteen months, and judging from the experiences of other localities, so far as conditions are similar, together with reports along allied lines by other investigators, the New York Bay Pollution Commission concludes as follows:

(1) It unhesitatingly protests against the consummation of the plan of construction outlined by the Passaic Valley District Sewerage Commission.

(2) It recommends that the Legislature authorize the Governor of the State of New York to appoint a Metropolitan District Sewerage Commission. This Commission should continue similar examinations to those conducted by the New York Bay Pollution Commission and should thoroughly investigate the questions from engineering and economic standpoints, and make preliminary surveys for, and estimates of cost of, a comprehensive system for ocean disposal of the sewage of the whole or the greater portion of the districts in both New York and New Jersey which are naturally tributary to New York Bay and adjacent waters. Such act of authorization should include a request that the State of New Jersey appoint a similar commission to work conjointly with that representing New York; the two commissions to cöoperate in the investigations and recommendations as to a comprehensive scheme of ocean disposal for the district and to outline a course of procedure for later authoritative action by the two States, respectively, and the Congress of the United States.

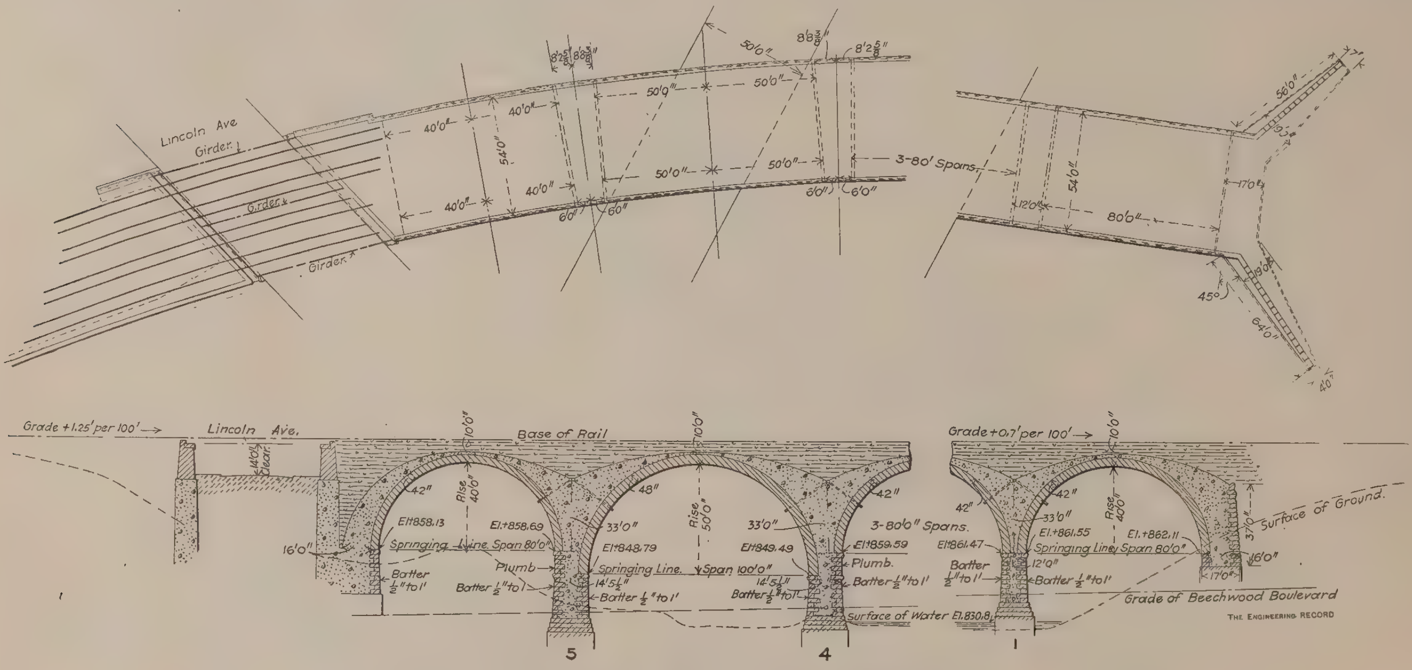
In the event of the State of New Jersey pressing the construction of the proposed Passaic Valley sewer as planned, if such be authorized by constitutional legislation, the Commission would recommend:

(3) That the Attorney General of the State of New York be authorized and directed to bring an action in the Supreme Court of the United States against the State of New Jersey and the Passaic Valley District Sewerage Commission, upon his attention being called to any act of said State of New Jersey, or said Sewerage Commission, towards carrying into effect the construction of said proposed sewerage system.

THE PREVENTION OF RAVELING on the State roads of Massachusetts is accomplished most successfully by the use of a thin coat of sand.

The Brilliant Cut-off of the Pennsylvania R. R.

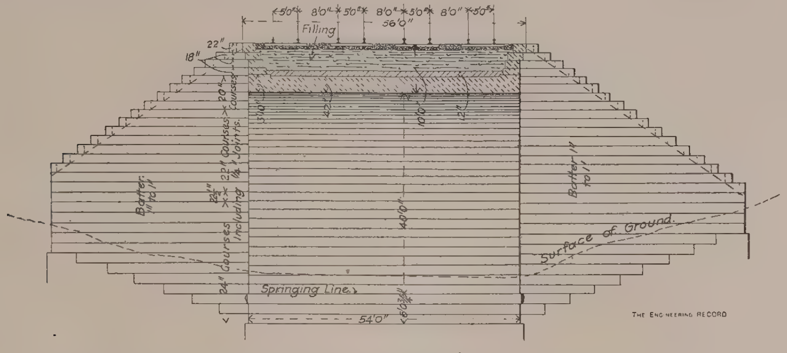
The opening of the Brilliant cutoff on the Pennsylvania Railroad at Pittsburg will greatly relieve the congested traffic conditions that have existed there for a number of years. Pittsburg is built on a long, narrow strip of land, which gradually increases in width from the junction of the Monongehela and Allegheny Rivers at the lower end of the city. Beginning about a mile from the extreme point of this strip, and extending back for several miles, are a series of high, steep, irregular hills with deep, narrow valleys between them. The main line of the railroad enters the city from the east through one of these valleys, and passes on to a switching yard and union passenger station not far from the center of the business district. From this station the main line tracks turn to the north, and are carried on a steel viaduct across the city to a three-track bridge over the Allegheny River, from which they pass to the yards of the station at Allegheny City.



Part Plan and Part Elevation of Siver Lake Arches, Brilliant Cut-Off.

The two tracks of the Allegheny Valley Railroad also come in from the east, paralleling the Allegheny River on its south bank along the foot of the steep hills, which rise directly from it, and crossing a portion of the city at grade above the union station, enter the switch yard there. The double-track West Penn Railroad lies along the north bank of the same river, but terminates in Allegheny City. Both of these lines are controlled by the Pennsylvania Railroad Co., and there is a heavy interchange of traffic between them and the main line. Heretofore freight from the main line for the Allegheny Valley branch had to come into the yard at the union station and be switched across the city through a closely built-up section to that branch. Freight from that branch for points along the main line east or west of Pittsburg was handled in the opposite manner. Freight for Pittsburg or points east on the main line from the West Penn and from the main line for that road had to pass through the yard at the union station over the three tracks on the viaduct and the river bridge to a transfer yard in Allegheny City. The through freight and passenger traffic on the main line is very heavy, and, together with the switching movements necessitated by the interchange of traffic between the two branches, greatly congested the switch yard in the city. This was the only one available, however, and its size is greatly limited by the abruptness of the sides of the valley in which it is located.

The construction of the Brilliant cut-off was undertaken to divert all but the passenger and local freight traffic from this yard and to avoid entirely passing the heavy movements of through freight through the city. Although it is but 3 miles long, it has been constructed at a cost of about $3,500,000, excluding track, superstructure of bridges and right of way, owing to the rugged country that is crossed. The cut-off branches from the main line about six miles east of the union station in the heart of the best residential section of the city at East Liberty, and runs almost due north to the Allegheny River, which is crossed to obtain a junction with the West Penn Railroad on the north bank. Near the south end of this bridge a double-track connection is made with the Allegheny Valley Railroad, which follows the river on its south bank. The branch has four tracks throughout, with the exception of the connection with the Allegheny Valley and the bridge over the river, which are both double track.



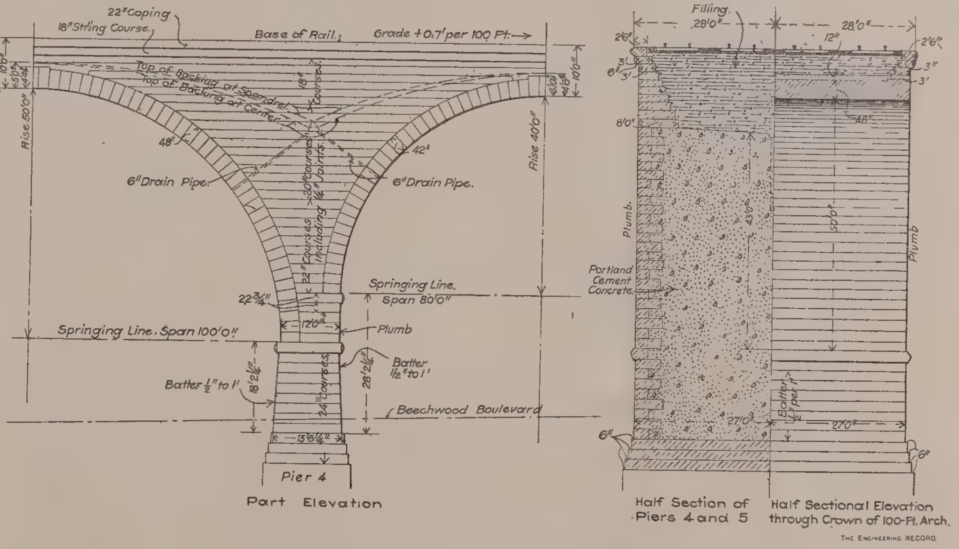
Masonry Details at West Abutment of Silver Lake Arches.

From East Liberty to Silver Lake, a small pond surrounded by a public park, the lines passes through the most thickly built up residential section of the city. This was the only possible route on which a line with low gradients and slight curves, such as are required by the nature of the traffic to be handled, could be built.

Permission could not be obtained to build an embankment across the ravine in which the lake is located, so the choice lay between a steel bridge and a series of masonry arches. Following the usual policy of the company to use masonry in preference to steel for heavy-traffic bridges on permanent locations, the crossing was made on six masonry arches. The general detail of the arches is shown in an accompanying cut. Five of them are of 80-ft. span, with a 40-ft. rise, while the sixth one has a 100-ft span, with a 50-ft. rise. The line is on a 5-deg. curve over the arches, but the building of the piers on a skew was avoided by gradually increasing their thicknesses from the inside to the outside of the curve. The piers and abutments are founded on solid rock at a depth varying from 12 to 20 ft. below the surface. Concrete was used in the foundations, the core and the backing, but none of it appears on the surface, which is made of Clearfield County sandstone. The stones have a quarry face, while the corners of the piers, the edges of the outside voussoirs and the copings have a 2-in. chisel draft cut. The concrete was mixed in the proportions of 1 of cement, 2 of sand and 5 of gravel. Giant and Dragon brands of American Portland cement were used, while the sand and gravel were obtained from the bed of the Allegheny River, near the end of the cut-off, where an exceptionally good and uniform quality is found. The cost of this structure alone was over $500,000.

Just beyond the north end of these arches the tracks are carried over Lincoln Ave. on a 50-ft. plate-girder bridge, with a solid trough floor, three girders carrying the four tracks. From the end of this bridge to the crossing of the river, the location presented an unusually difficult problem. A deep, narrow valley extends the full distance, along the west side of which, for some distance, is located the most exclusive residential section of the city, and beyond that toward the river is a large public park on the side and over the top of the hill rising from the valley. Along the bottom is Beechwood Boulevard, a wide pleasure drive connecting the park system of the city. The only choice for a line down this valley was to build it on a bench in the side of the hill at the east and from 75 to 125 ft. above the bottom of the ravine, in order not to interfere with the park or boulevard.

That side of the valley was very abrupt, and was cut through at several points by deep gulches, occasioning some unusually heavy work to bring a bench along it wide enough for four tracks to grade. The material encountered varied from a hard clay to solid rock, but the greater part of it was a hard shale or disintegrated rock. The line is a succession of cuts and fills from the Silver Lake arches to the river, and approximately 2,500,000 cu. yd. of pay quantities were moved in providing a location for the tracks.



Details of Pier and Arch, Silver Lake Arches, Brilliant Cut-Off.

The cut-off crosses the Allegheny Valley tracks on the south bank of the river at right angles to and about 45 ft. above them, the connection being effected by a double track turnout. The placing of this connection required the most difficult piece of grading on the whole work. It leaves the cut-off on a 6-deg. curve, and passing along the edge of the hill parallel to and above the Allegheny Valley R. R., descends for nearly a mile on a 1.5 per cent. grade to a switching and transfer yard on that road at Coleman. The side of the valley on which the cut-off is built terminates abruptly at the point near the south end of the new bridge where the connection is diverted. The hill here formerly rose almost perpendicularly on both the river and valley sides for about 200 ft. above the site of the tracks. To place the tracks the nose of this hill had to be cut back nearly 250 ft., and down to a depth of about 180 ft. from its top, requiring the excavation and removal of nearly 1,000,000 cu. yd. of material. At one time three steam shovels were at work here, and upward of 25 Porter industrial locomotives were employed in handling the spoil cars. The hill recedes more rapidly from the river a short distance farther along the connection, and the tracks are carried on a side-hill bench made partially by excavating and partially by filling. A temporary trestle was erected nearly the length of this work, and a considerable portion of the excavation from the big cut was dumped from it to make the fill.

A high masonry retaining wall had to be built for about 200 ft. near the point of the hill to hold the fill off the tracks of the Allegheny Valley R. R. and to insure safety to the pumping plant of the Pittsburg City water works which is situated between those tracks and the river at this point. During the construction a slide on the side of the hill immediately above the fill pushed this wall out and threw the railroad tracks several feet out of line. Some anxiety was occasioned regarding the liability of another slide interfering with the operation of the pumping station, but the danger was of no great moment and no further trouble was experienced.

The yard at Coleman prior to the carrying on of these improvements was only a small sorting yard for the freight destined for the main line and for the other branches of the company leading out of Pittsburg. It has been considerably increased in capacity since the construction of the cut-off was commenced, by excavating a wide strip on the side of the hill along the river and by extending and lengthening its tracks until it now has ample capacity for the sorting, transferring aud storing of all the business that is tributary to it.

The double-track bridge over the Allegheny River has a total length of 1,429 ft. from the south abutment to the point where the two approaches to it at the north end separate, and its tracks are nearly 70 ft. above high water in the river. Two deck plate-girder spans, one of 91 ft. 6 in. and the other of 92 ft., extend from the south end to a 156-ft. 6-in. deck Pratt-truss span reaching to the south edge of the river. Three through Pratt trusses with inclined top chords form the river crossing. The channel span is at the south, with a total length between centers of 407 ft., and the other two river spans are each 248 ft. 6 in. long.

Approach is made to the north end of the bridge from the West Penn R. R. on two separate double-track structures, which divide just beyond the end of the north span, one turning to the east and the other to the west, both on 8-deg. curves, to join the tracks of that road, which lie at right angles to the bridge.

The foundations for the bridge were built according to the standard specifications of the Pennsylvania Company for bridge masonry. They are of sandstone laid in Portland cement mortar, with granite bridge seats and sandstone copings. The face stones were left as they came from the quarry, except where projections exceeded 2 in., when they were roughly scabbled down. Those forming the points of the piers which act as ice breakers were dressed on their faces and clamped together with iron clamps. The south abutment and the two piers to the south are founded on solid rock, while the remaining piers were placed on pile foundations. The piles were spaced 2 ft. 9 in. apart on centers, in rows spaced the same distance, and were driven from 12 to 25 ft. in the bed of the river, which is of coarse gravel. A layer of concrete 4 ft. thick was placed around and over the heads of the piles, and on top of this was laid the timber grillage, 5 ft. thick, on which the masonry of the piers is built.

As the erection of the steel work of the channel spans was nearing completion an ice jam occurred in the river just above the falsework on which the bridge was being built. It was only by great effort that the work was completed in time to avoid a disaster, as a portion of the falsework was swept away a short time after the trusses were swung from their supports by the flood which had backed up above the jam. The steel work was furnished and erected by the American Bridge Co.

The approaches are both made up of deck plate-girder spans on the ends at the bridge. The east approach is a fill from the end of the steel work to the point where it descends to the level of the tracks of the West Penn R. R. About 500 ft. from the beginning of this fill it crosses those tracks on a skew deck plate-girder span supported on masonry abutments. From this crossing the approach closely parallels the tracks to which it finally descends. The fill on which it is made is held in place by a retaining wall on either side as it is built on a narrow space between the tracks and a public highway. This approach has a total length of 3,500 ft., and is nearly level from the bridge to the overhead crossing from which it descends on a 1.5 per cent. grade.

The abutments on which the overhead track span rests both have ashlar masonry facing, with granite bridge seats and concrete backing. The south one is 25 ft. high and 182 ft. long, while the north one is of the same height and 138 ft. long, both of them being built on a slight curve to fit the curve in the tracks between them. Their unusual length for double track abutments was required by the sharp skew at which the crossing passes over the tracks.

The retaining walls from the north abutment to the end of the approach are of sandstone rubble masonry laid in cement mortar and covered with a dressed coping 18 in. thick. They are built in the limited space between the tracks and the highway, so have their outside faces vertical, with their back faces roughly battered. They decrease from 22 ft. in height at the crossing to 2 ft. high at the end, and are built on a concrete foundation from 4 to 10 ft. deep, made of 1 part Portland cement, 6 parts sand and 8 parts gravel. Unusually rapid progress was accomplished in their construction, as the total of 20,000 cu. yd. contained in them and the two abutments at their west end was placed in a little over three months. Three stiff-leg derricks with 45-ft. masts and a range enabling them to cover the site of both walls were set up on the highway side. The concrete foundations were kept considerably in advance of the walls, most of the concrete being mixed by hand, although two Smith mixers were used to some extent. Enough of the fill between the walls was made as they progressed from the low end to keep the track on it at such a height that cars brought in from the main tracks were at the most convenient level for operations. Work was carried on night and day the greater part of the time, and from 100 to 150 men were employed in the construction work.

The west approach is also a fill from the end of the steel work at its bridge end until it becomes parallel with the tracks near the junction. From this point it descends on a timber trestle with its tracks on a 1.2 per cent. grade to the level at the junction with the West Penn tracks. It is intended to lay out a switch yard between the approach and the river, but its location has not as yet been decided upon, so the trestle was temporarily constructed pending the determination of the site of the yard. The timbers for the trestle were all cut and fitted together in the bents on the ground at their respective sites. When the bents, varying from 3 to 20 ft. in height, had been assembled they were erected successively, the highest first, by block and tackle, and the stringers on which the ties are laid placed as the erection advanced.

The fill in the west approach and in the east one as far as the track crossing, were made by dumping from temporary trestles. The material was hauled across the bridge from the excavation of the hillside at the south end of it in trains of 4-yd. dump cars drawn by Porter locomotives. The trestles were erected as the fills were brought to grade, and the dumping done from both sides of the track on them. Both these fills were made wide enough to carry double tracks, and are from 20 to 25 ft. high, so a total of nearly 65,000 cu. yd. was required in bringing them to grade.

When the cut-off is finally in complete operation the eastbound, main line freight traffic will come up the double-track West Penn branch from Allegheny City to the new bridge and go over it and the cut-off and reach the main line again at East Liberty, thus avoiding the depot yard at Allegheny City, the bridge and viaduct from it to the Pittsburg station, and the limited track room from that station east through the city. The westbound through freight will be handled in the opposite manner, and also avoid those congested facilities. Freight from the east or west on the Allegheny Valley branch can be diverted at the connection between that road and the cut-off. The same will be true of the interchange with the West Penn for freight from the main line or for the main line from it. It will also be possible to divert the through passenger service over the new line and further avoid delays and congestion as the station at East Liberty is readily accessible from all parts of the city. When the yard at the west approach to the north end of the river bridge is completed it will be used for sorting and storing the main line traffic.

The contract for constructing the two approaches at the north end of the river crossing and the piers and abutments on which they rest was let to Drake & Stratton, of Pittsburg. The balance of the work was prosecuted by the Columbia Contracting Co., of Pittsburg. The steel work was all furnished by the American Bridge Co.

The line was located under the direction of Mr. William H. Brown, chief engineer of the Pennsylvania Railroad, and was built under his supervision and that of the late William A. Pratt, assistant to the chief engineer, Mr. Norman F. Brown, assistant engineer of construction, being in direct charge. The plans for the masonry arches were made by Mr. E. B. Temple, assistant engineer.

The Pine Creek Long-Span, Plate-Girder Bridge.

The Pine Creek double-track skew deck bridge one mile west of the Jersey Shore Junction in the Beech Creek district of the Pennsylvania Division of the New York Central & Hudson River Railroad has three duplicate 127-ft. 10-in. main spans and one 33-ft. 8-in. approach span. Each track is carried on a pair of independent plate girders which form a separate span, and are proportioned for two 142-ton locomotives followed by a train load of 4,500 lb. per lin. ft., or for two 60,000-lb. axle loads and the same train load, for a track load of 400 lb. per lin. ft. of bridge, for a steel load of 1,800 lb. per lin, ft. of the long spans and 700 lb. for the short span, and for a top lateral wind pressure of 200 lb. static and 300 lb. moving and a bottom lateral pressure of 150 lb. per lin. ft. The maximum computed stresses in the main spans were: Bending moment, dead load, 2,170,000 ft.-lb.; live load, 5,024,000 ft. lb., and live plus ½ dead, 6,109,000 ft.-lb.; shear, dead load, 70,400 lb.; live load, 181,500 lbs., live plus ½ dead, 216,700 lb.

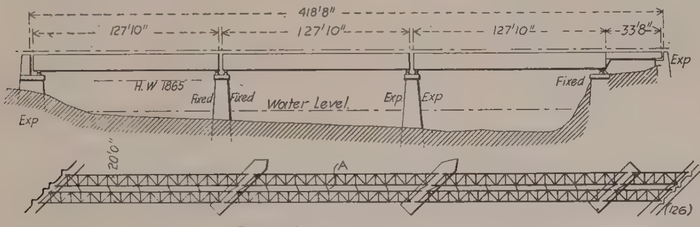
Each flange in a long girder has two full-length 8x8x1⅛-in. angles and one 20x⅝-in. cover plate, one 94, one 82 and one 68-ft. 20x⅝-in., and one 44-ft. 20x½-in. cover plate, all aggregating 83 sq. in. in net cross sectional area, and requiring rivets with a maximum grip of 4⅛ in. The angles and the first and second cover plates are spliced, and the ends of the outer cover plates are extended to splice the inner ones. The web plates are ½ in. thick throughout, are cambered ¾ in., and have joints from 15 to 20 ft. apart, all spliced with pairs of 14x½-in. cover plates, with four vertical rows of rivets close together.

The web stiffeners are, except over the bearings where there are extra ones, from 4 ft. apart at the ends to 5 ft. apart in the middle, and are all made with pairs of 5x3½-in. angles with double filler plates.

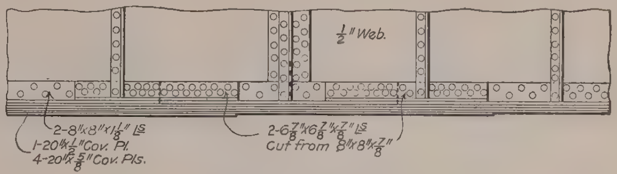
Each bottom flange angle is made in three pieces, those on one side of the web having successive lengths of 38 ft. 10⅜ in., 54 ft. 7⅞ in. and 34 ft. 3¼ in., while those on the opposite side have respective lengths of 33 ft. 10 in., 52 ft. 6⅜ in., and 41 ft. 5⅛ in. The corresponding top flange angles have the same lengths or are a few eighths inch longer, as required for the camber. This arrangement staggers the joints of the angles in the same flange on opposite sides of the web where they are alike for top and bottom flanges on the same side of the span center, but differ on opposite sides of the center. On one side both angles are spliced with a pair of cover angles about 10 ft. long, on the other side each angle joint is spliced with a separate pair of angles about 5 ft. long, all the splice angles being made from 8x8x⅞-in. bars with each flange cut down to 6⅞ in. wide, and the back rounded to fit the fillet of the flange angle.

The girders have fixed ends at one abutment, and expansion ends at the other abutment, and at one pier both spans have fixed ends and at the other pier both have expansion ends. Riveted steel shoes are riveted to the lower flanges of each main girder, 125 ft. 4 in. apart on centers, and have 5 15/16-in. pins engaging the riveted pedestals, all being alike at fixed and expansion ends except that the expansion end pedestals have roller plates, which are omitted on the fixed end shoes. The shoes have base plates of the same width as the lower flange cover plate, and have three webs, which together with the angles provide 29.7 sq. in. pin bearing. The center web is in the plane of the center web of the pedestal, and has a half-hole bearing and the side webs have full hole bearings and clear the pedestal webs.

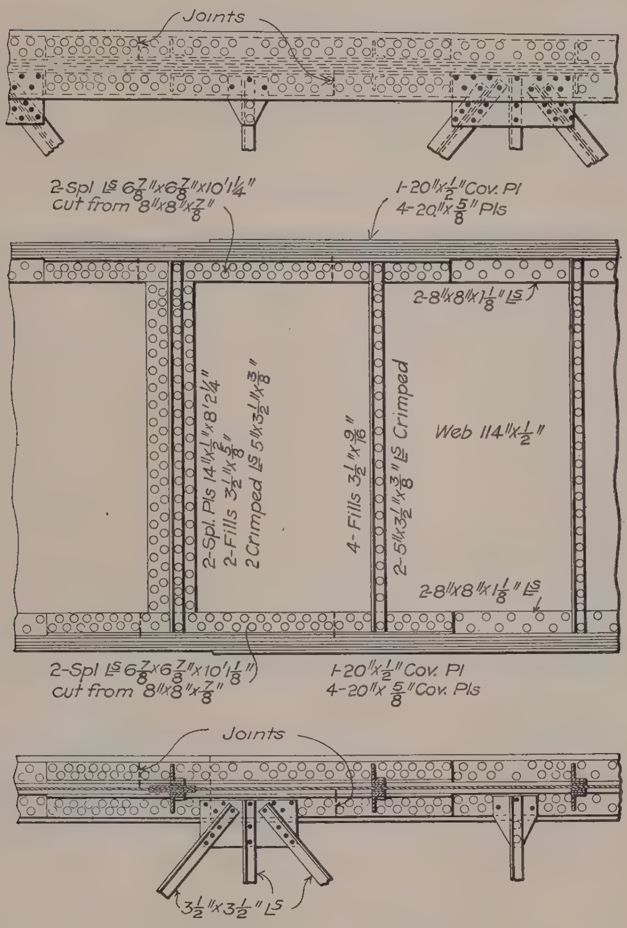
The pedestal base plate is much wider than that of the shoe, and its webs are thicker so as to give 29.6 sq. in. pin bearing. Vertical angles are riveted to the webs on the center line of the pedestal with their outstanding flanges in contact and riveted together so as to form Z-shape transverse diaphragms connecting the webs and slotted at the top to clear the side webs of the shoe. At the expansion end the pedestals are seated on 158 lin. in. of 4-in. rollers with shouldered ends engaging 4½-in. end strips, which engage the planed edges of the roller plates and bolster beds, and form tight sliding joints to exclude dust. Outside the end strips horizontal guard angles are bolted to the tops of the bolsters to form additional security for the dust guard.



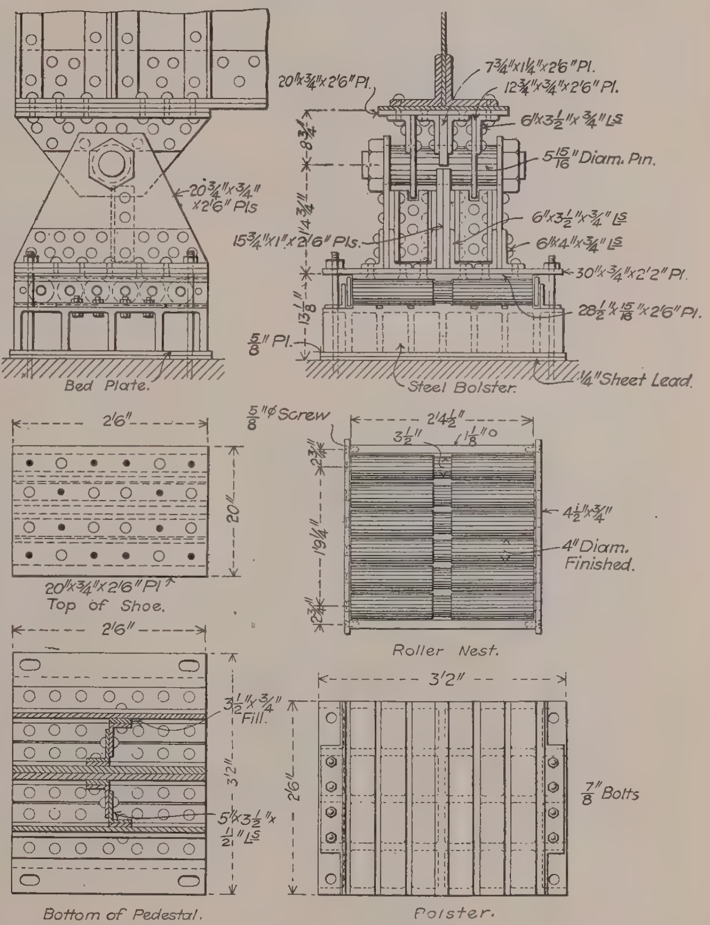
General Plan and Elevation.



Second Flange Splice.



Lateral Connections and Splices.



Expansion End Bearing.

The rollers rest on a cast-steel bolster with top plate and longitudinal and transverse vertical webs about 4 and 6 in. apart. It has no bottom plate, but the lower edges of the vertical webs are planed and are seated on a ⅞-in. rolled steel bottom plate, between which and the masonry a sheet of soft lead ¼ in. thick is interposed to prevent irregularities of bearing in the 1,084 square in. of surface. On the piers the bottom plates and lead sheets are each made long enough to receive the two adjacent bolsters. At the expansion bearings the top of the masonry is 13 ft. 9½ in. below the rail base, and at the fixed bearings it is 5¾ in. higher to compensate for the omission of rollers and roller plates.

The 127-ft. girders are connected by swaybrace frames riveted to the vertical web-stiffener angles and by top and bottom zig-zag lateral angles riveted to the flange angles and cover plates. The top laterals are pairs of 3½x3½ to 5x3½-in. angles, and the bottom angle laterals are single 3½x3½x⅜-in. angles. The two inside girders are connected together by oblique horizontal struts composed of a pair of 3½x3½x⅜-in. angles, which are connected to the top and bottom flanges. The fixed river end of each short span girder is seated on a bracket which is riveted to the end vertical web-stiffener angles of the adjacent long span girder and supports the live end and dead loads. Both spans are riveted together through the lower flange of the short girder, and through the end vertical angles of both girders. Sole plates ¾-in. thick and 19 in. wide are riveted to the shore ends of the lower flanges, and project about 4 in. beyond them on each edge to receive 1½-in. wedge anchor bolts through slotted holes 2 in. long. The plates are planed to a bevel of ⅛ in. in their length to correspond to the grade of 0.61 per cent., and are seated on planed ¾-in. bed plates with pieces of sheet lead ¼ in. thick and ½ in. longer and wider interposed between them and the stone abutment seats. The girders are made with single 32x9/16-in. web plates and 6x6x11/16-in. flange angles, reinforced by double thicknesses of 14-in. cover plates. The angles have a double row of rivets through their vertical flanges, and a single row through each horizontal flange. The web is divided into panels of about 4 ft. by pairs of 3½x5-in. vertical angles and fillers, the outstanding flanges of the former affording connection at the ends and center of the span for the sway braces. The total weight of the bridge is 789 tons, 24 tons being for the 33-ft. span, so that the weight of each 127 ft. 10 in. girder and its share of bracing is 127,500 lb.

This bridge replaces a single track 384-ft. span built by the Union Bridge Co. and designed for a lighter service than is now required. The new substructure was built underneath the old span, while the latter was in service, and piles were driven between the piers and falsework erected to support the old span and the ordinary wooden tower traveler by which the former was taken down. In the middle of the bridge one bent of piles was omitted and the double panel there was spanned by long plate girders carrying the track stringers on a short intermediate bent of falsework and affording an increased width of waterway which eventually proved very necessary to pass a great jam of logs which came down the creek in flood and without it would have greatly endangered the falsework which, as it was, required much labor to pass the logs safely through it.

The main girders were shipped whole from the bridge shop, and were unloaded from the cars near the site, by a 60-ton steam derrick car at one end and a 40-ton car at the other end. They were set on skids near the track, and remained there until the old trusses were removed, when the derrick cars lifted them, carried them out on the falsework and deposited them in place. There were 8,646 ⅞-in. field-rivets, all of which were driven by pneumatic hammers.

The bridge was designed and constructed under the direction of the engineering department of the New York Central & Hudson River Railroad Co., Mr. H. Fernstrom, chief engineer; Mr. Olaf Hoff, engineer of structures, and Messrs. G. A. Berry and A. W. Carpenter, engineers of bridges. The Pennsylvania Steel Co., Mr. J. V. W. Reynders, superintendent of the Bridge and Construction Department, was the contractor for the steelwork, which was erected by the bridge department of the railroad.

Book Notes.

The fourteenth annual edition of "Hendricks' Commercial Register" is a careful compilation of over 350,000 names of people engaged in architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying and kindred industries. These names are classified under a great many heads so as to be readily found, and there is a good index to assist the user of the book. The book is too well known to need any extended review. (New York, S. E. Hendricks Co., $7.00.)

A clear-cut explanation of the "Elements of Plane and Spherical Trigonometry" has been written by Prof. P. A. Lambert, of Lehigh University, and Mr. H. A. Foering, of the Bethlehem Training School. It is agreeably free from any of the fireworks that disfigure so many mathematical books, and gives about all the trigonometry an engineer needs in such a form that the book can be mastered by those who have to depend on self-instruction. (New York, The Macmillan Co.)

The 1904 report of the superintendent of the U. S. Coast and Geodetic Survey is mainly interesting to engineers on account of the appendices by Mr. L. A. Bauer on magnetic observations in 1903-4, by Mr. Edwin Smith on telegraphic longitudes, by Mr. Rollin A. Harris on cotidal lines for the world, by Mr. John F. Hayford on precise leveling in Wyoming, Idaho and Texas, and on a test of a transit micrometer, and by Mr. A. L. Baldwin on triangulation in California. The appendix by Mr. Harris is a supplement to one published in 1900 which aimed to obtain by theoretical methods a first approximation to the times of the principal ocean tides. The new paper aims at a system of cotidal lines, which, while conforming to all reliable data, shall reasonably satisfy the requirements of the theory previously outlined.

CYCLOPEDIA OF APPLIED ELECTRICITY. Chicago, American School of Correspondence; five 8vo volumes, ¾ leather, about 2,500 pages, $18.00.

This work is the most comprehensive work on electricity and its practical applications that has yet been published. To be able to turn quickly to any phase of electricity is of equal value to the busy practical man and the engineering student. In these volumes the reader finds a treatment of the latest developments of electricity by acknowledged authorities, fully indexed, and written in a simple direct way. The work is not addressed to the technically educated specialist, and for this reason all of the descriptions and explanations which it contains have been simplified to the utmost possible degree consistent with a thorough presentation of the subjects treated. Higher mathematics have been entirely omitted, and the subject matter of the work is explained in simple language in connection with a large number of diagrams prepared especially for the text. The engravings are of special value as they illustrate the electrical machines and apparatus made by the prominent electrical companies in the United States and therefore acquaint the reader with the types of apparatus used in current engineering practice.

The assistance of many eminent specialists has been obtained in the preparation of these volumes, among whom may be mentioned Prof. F. B. Crocker, of Columbia University; Prof. William Esty, of Lehigh University; Prof. D. C. Jackson and Prof. George C. Shaad, of the University of Wisconsin; Prof. Louis Derr, of the Massachusetts Institute of Technology, and many others, all of whom have prepared special articles and aided in the collaboration of this work. All of the standard works of technical literature have also been freely drawn upon in the preparation of these volumes.

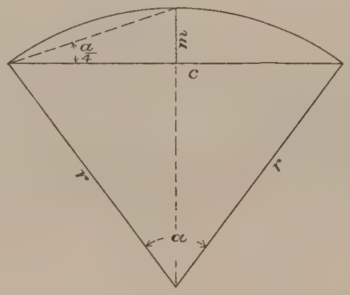
As these books have been designed for textbooks a great deal of attention has been given to practical examples, and each volume is supplemented with a list of review questions by means of which the reader can test for himself the knowledge which he has acquired of the subjects treated.

The usefulness of the cyclopedia as a reference book is augmented by the addition of a subject index contained in the fifth volume. The practical value of the work as a whole can hardly be questioned, as the cyclopedia embodies the various electrical courses which have been successfully used by the American School of Correspondence in teaching thousands of electricians. The work is, in fact, the outcome of a most successful method for the education of the busy man. It will be found of value to designers, constructors, and operators of electrical machinery, and as it is the only textbook and reference work covering every department of electricity thoroughly, its use will save many valuable hours of search among scattered textbooks on electricity.

Letters to the Editor.

AREAS OF CIRCULAR SEGMENTS.

SIR: In The Engineering Record for March 25 is given the following approximate formula for the area of the segment of a circle, where c = chord of the arc, m = mid-ordinate or versed-sine.



$$\text{Area} = \frac{2}{3}cm + \frac{m^3}{2c} \ldots\ldots\ldots\ldots (1)$$

The formula is applied to a problem given in the Record for Feb. 18.

In order to use such a formula with confidence, the limits of the error should be stated.

$$\text{Area of sector} = \frac{1}{2} r \times \text{arc} = \frac{1}{2} r^2 a, \text{ where}$$

a is the radian measure of included angle or arc.

$$\text{Area of triangle} = \frac{1}{2} r^2 \sin a.$$

$$\text{Area of segment} = \frac{1}{2} r^2 (a - \sin a).$$

Since $r = \quad c^2 + 4m^2 \quad \div 8m$ and $\tan \frac{1}{4} a = 2mc$.

$$\text{Area of sector} = \left(\frac{c^2 + 4m^2}{16m}\right)^{2} \times 4 \text{ arc tan}$$

$$\frac{2m}{c} = \frac{c^3}{16m} + \frac{5cm}{12} + \frac{8m^3}{15c} - \frac{32m^5}{105c} + \frac{128m^7}{315c} - \ldots\ldots$$

$$\text{Area of triangle} = \frac{c^3 - 4cm^2}{16m}$$

Subtracting we have,

$$\text{Area of segment} = \frac{2}{3}cm + \frac{8m^3}{15c} - \frac{32m^5}{105c^3} + \frac{128m^7}{315c^5} - \ldots\ldots\ldots\ldots (2)$$

For an approximation when the angle a is mall, that is, when m is small in comparison with c, we may neglect the terms containing the 5th and higher powers of m, and we have

$$\text{Area} = \frac{2}{3}cm + \frac{8m^3}{15c} \ldots\ldots\ldots\ldots (A)$$

A more accurate formula than the one given for small angles. In the example worked out, the angle $a = 148° 30'$ and therefore formula (A) does not give as good an approximation as (1), the values being:

True area = 4.3861.
Formula (1) gives 4.3892.
Formula (A) gives 4.4176.

This example, however, happens to be such that Formula (1) gives the result with only a slight error. The formula is objectionable from the fact that the relative error increases as the angle a decreases. For angles less than 90°, (A) will give a closer approximation and the relative error decreases with the decrease of the angle a.

A more approximate formula than either of the above is:

$$\text{Area} = \frac{2}{3}mc + \frac{56m^3c}{15(7c^2 + 4m^2)} \ldots\ldots (B)$$

If this expression be expanded in infinite series and compared with (2) the closeness of the approximation will be apparent.

Yours truly, E. B. ESCOTT.
Ann Arbor, April 26.

THE LENGTH OF CIRCULAR ARCS.

SIR: In your issue of March 25 there is a table given by Mr. S. D. Bleich for finding the length of circular arcs when the chord and middle ordinate are known. For a ratio 0.01, the coefficient is given as 1.0000; it should be 1.0003. For a ratio 0.03, the coefficient is given as 1.0027; it should be 1.0024. The next one should be 1.0043 in place of 1.0047; the next should be 1.0067 and not 1.0071. Several others were tried and found to be in error.

Yours truly, EDWARD GODFREY.
Pittsburg, April 19.

[Mr. Bleich states that the formula and coefficients were only intended as fair approximations, as explained in his note, and were not claimed to be strictly accurate.]

CURRENT NEWS SUPPLEMENT

MAY 6, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23. Next meeting, May 17, paper on irrigation at Ontario, Cal.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23. Next meeting, May 16, papers on relays, circuit-breakers and oil-switches, and the proper limit of duplication to secure reliability of service.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth St., Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C. Annual convention at West Baden, Ind., May 8 to 12.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

THE BROOKS CENTRIFUGAL PUMP.

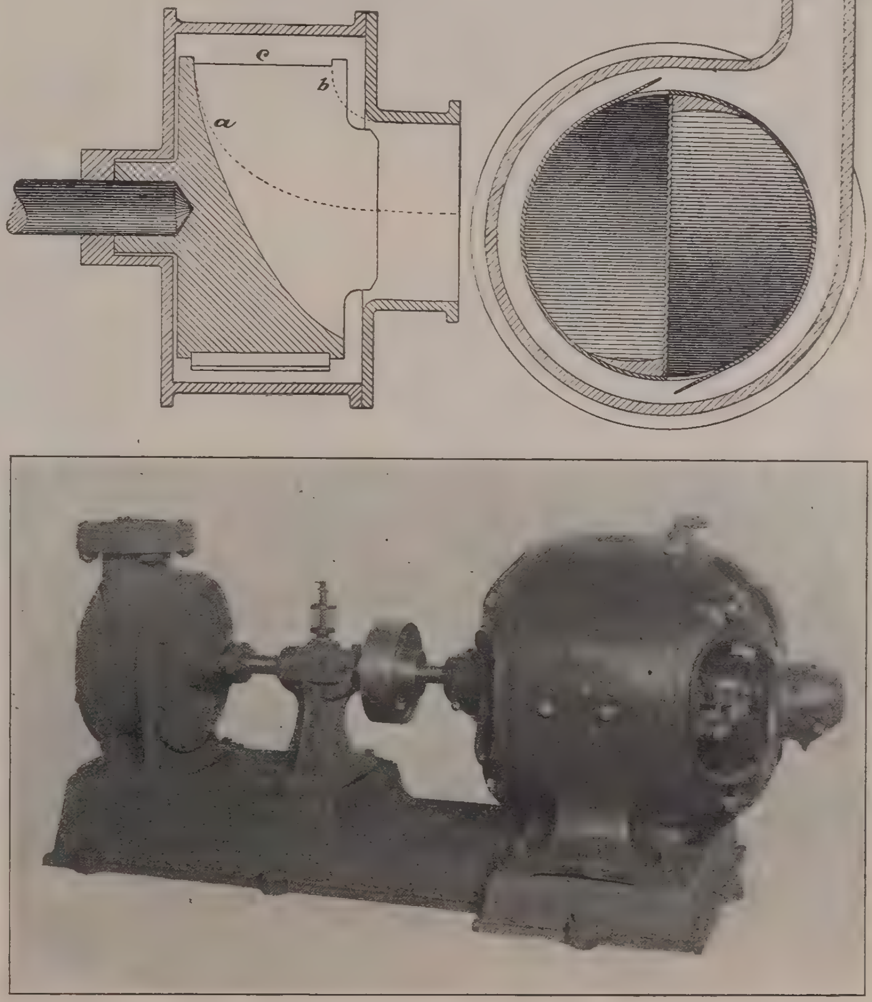
The Brooks centrifugal pump differs materially in its form from the usual shape of such apparatus, and the reason for this is explained substantially as follows by the builders, the Dayton Hydraulic Machinery Co., Reibold Bldg., Dayton, O. The motion of the water inside a pump of this type depends, according to this company, on the centrifugal force imparted to it by the runner and the velocity at which it enters the pump. If it enters on the axis of rotation or parallel to it, its motion along this line must be deflected in order that the water may be discharged through the outlet, and the designer's main object must be to produce this change in direction without wasting power in eddy and impact effects.

The builders of this pump point out that the water entering the casing near the axis will be deflected radially very slowly at first, and with increasing force and abruptness as it moves from this axis and comes under the influence of the parts of the runner having greater speed. The liquid that enters at the periphery comes immediately under the influence of a rapidly moving part of the runner, and will attain its outward direction of flow more quickly. These resultant lines are indicated by the curves *a* and *b* in the sectional diagram, which are stated to be plotted from data obtained by many tests. The surfaces of the pump have been given a shape which avoids cutting these curves and thus eliminate eddies and impact.

Since it is the purpose of this pump to accelerate the motion of the liquid passing through it, the area of the outlet from the hollow piston must be substantially less than the total inlet area, or else the delivery outlets will not be kept filled and the pump will be inefficient.

If the pump shown had its diameter increased but the other dimensions and peripheral speed retained, its rate of revolution would be much slower and the curves of the water would not be so sharp. This would result in a less efficient pump, and hence the Dayton company prefers to employ a pump runner of small diameter driven at a high speed to one of large diameter driven more slowly. Another feature of the design to which the company draws attention is the lip that overhangs each of the two outlets of the runner. These lips serve as guards or division plates keeping the outflowing water from impinging directly against the annular liquid mass between the casing and runner, thus reducing eddy action and, to some extent, impelling the liquid towards the casing.

The general appearance of the pump is shown in the accompanying illustration of a unit recently furnished to the Pabst Brewing Co. It is driven by a single-phase motor.



GENERAL VIEW AND SECTIONAL DIAGRAMS OF THE BROOKS CENTRIFUGAL PUMP.

MEDUSA WATER-PROOF COMPOUND FOR CONCRETE.

A new compound has just been put on the market for use with Portland cement to render mortar or concrete practically impervious to water. It has been invented by the makers, the Sandusky Portland Cement Co., Sandusky, O., after a long series of experiments and tests. It is believed that its use will do away with some serious objections to cement for certain purposes and will extend the field of concrete construction.

A small quantity of the compound is mixed very thoroughly with the dry cement before the addition of sand and water. An amount of the compound equal to one or two per cent. of the weight of cement will be sufficient for most purposes, but the precise amount can best be determined by experience. The makers state that a one per cent. addition is enough for hollow concrete building blocks, but a larger amount should be used in the lining of cisterns and reservoirs.

The great advantage of the compound, the makers state, is the saving in cement which it makes practicable. Comparatively lean concrete is strong enough for many purposes, but is so porous that it absorbs water like a sponge. The company states that cement with one per cent. of the compound and five parts of sand gives a more impervious mortar than ordinary untreated cement with two parts sand. It also states that hollow concrete blocks made with cement to which one per cent. of the compound has been added, with five parts of sand and gravel, resist water better than blocks of 1:3 concrete.

The compound is put on the market for use in building blocks, cement plastering, roofing tile, cellar walls, cistern and reservoir linings, conduits and other works where resistance to percolation is required. Experiments by the makers indicate that it will prevent the white efflorescence which so often disfigures concrete work and also check the appearance of hair cracks. This latter property indicates a possible use of the compound in concrete work exposed to salt water. According to Le Chatelier, the destruction of concrete by sea water is due to the diffusion of the sulphates of the water through the mass and the action of these salts on the constituents of the cement. By making the concrete impervious, such an action will be prevented, and the objection of many engineers to the use of concrete in sea works will be rendered baseless.

A WROUGHT-IRON PULLEY.

A new form of wrought-iron pulley has been brought out in England by Messrs. Mackies, Ltd., of Berks Ironworks, Reading. It is built up of a cast-iron boss, which receives the shaft, of flatiron arms bolted to the boss, and of a tee-bar bent into the circle of the periphery, riveted to the outer ends of the arms and carrying the rim or band of the pulley. The boss is provided with a central collar which is recessed to receive the arms. These are bolted in pairs, the recesses being in opposite sides of the collar. Any one arm can apparently be replaced without interfering with the other parts. The recessing of the boss is mainly to ensure that the stresses may come upon the sides of the recesses and not upon the bolts.

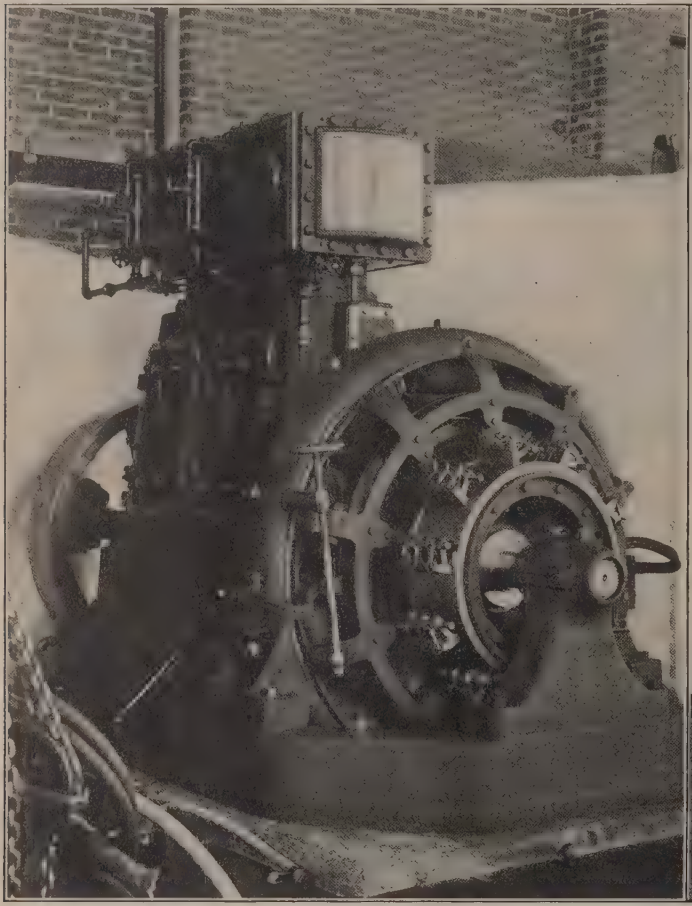
A COMPACT ELECTRICAL GENERATING SET.

A new series of designs of generating sets with direct-connected compound engines has recently been placed upon the market by the B. F. Sturtevant Co., Hyde Park, Mass., of which the 100-kw. size is illustrated herewith. The new series embraces five sizes, ranging from 17½ to 100 kw., which are particularly adapted for marine use or for use under conditions requiring a compact equipment. The designs were made to conform strictly to the requirements of the U. S. Navy Dept., for which a number of sets have been built.

The engine has an enclosed frame, with doors oil-tight yet easily detachable for access to the moving parts within, so as to provide for splash lubrication; this is assisted by a centrifugal oil thrower at each end of the engine shaft which floods the crank pins, etc. Force feed lubrication is also provided for at the other bearing parts and the rod stuffing boxes are rendered accessible from without the enclosed frame. The other features of the design indicate careful study—the high-pressure cylinder has a double-ported piston valve and the low-pressure cylinder a double-ported balanced slide valve, arranged to lift from its seat in case of water. The cylinders are protected from water by special relief valves at each end. Rites governors are used which maintain a speed regulation of within 1½ per cent. from no load to full load. The 100-kw. size, as herewith illustrated, operates at 350 rev. per min. under the steam pressure of 150 lbs.

The generator is of the multipolar engine-type with compound winding and has a two-circuit armature of the ventilated drum type. A special feature is to be noted in that a vertical adjustment is provided for the field frame for equalizing the air gap. The pole pieces embody a new construction of wrought iron with cast iron shoes permitting of easy removal for access to the field coils. The armature core is of a new design, which is effective in eliminating hysteresis losses and is still mechanically strong; particular attention was given to the securing of ample core ventilation. Insulation is another factor that has received careful attention, it being guaranteed damp proof and unaffected by temperatures up to 100 deg. C. The brushes are designed for a maximum current density of 50 amp. per sq. inch of bearing surface and are staggered to equalize the wear upon the commutator.

The set is subjected to rigid tests after erection, the engine being operated at overload without lagging to detect possible imperfections in the castings. The generators are designed to operate with 50 per cent. overload for short intervals and continuously at 25 per cent. overload, without sparking or undue heating. The electrical regulation secured is such that the voltage does not vary more than 15 per cent. when full load is thrown suddenly on or off.



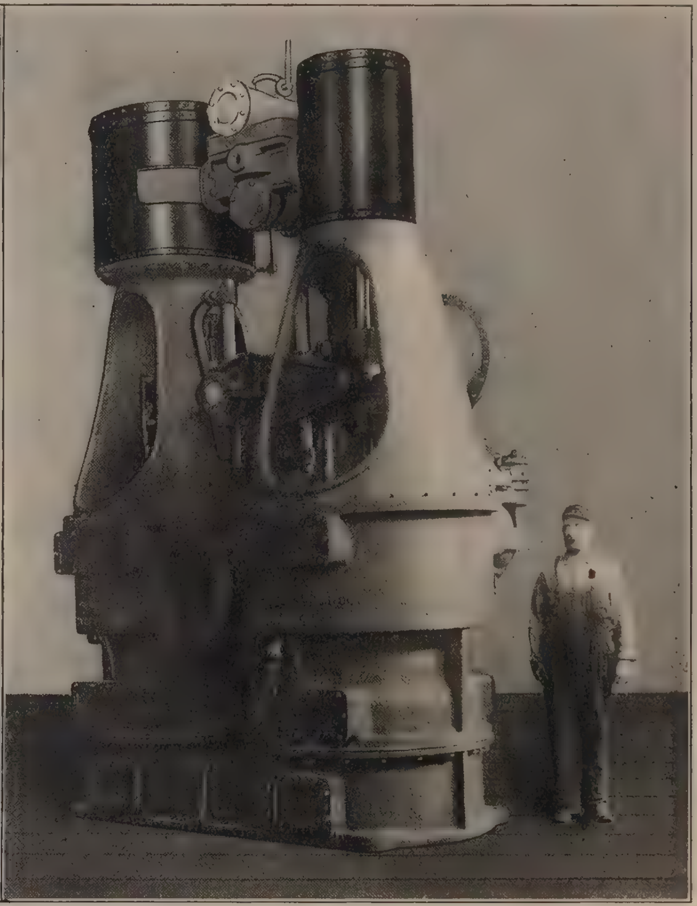
A 100-KW. MARINE-TYPE GENERATING SET.

THE W. H. BLAKE INDEPENDENT TWIN JET CONDENSER.

The advent of the independent air pump and condenser has had much to do with the practical development of the compound engine in medium and small sizes, for with this combination there are now obtainable economic results which not long since were expected only from the large compound engine with direct connected air pump. The usual effect of equipping a non-condensing plant for operating condensing is an increase of 20 to 30 per cent. in the output obtained coincidently with a reduction of 15 to 25 per cent. in the steam consumed per horse power. The convenience of application and operation of the separate condenser is, moreover, appreciated by every engineer.

That the jet and the surface type of condensers have their respective fields, is clearly recognized; neither type will meet all possible requirements. It was with this in mind that the new designs of condensers, now being manufactured by the W. H. Blake Steam Pump Co., of Hyde Park, Mass., were made to cover both types. The new standard designs range in capacity from 600 to 40,000 pounds of steam condensed per hour with injection water at 70 deg. F. One type is illustrated herewith, namely, the twin vertical air pump and jet condenser. The air pump is made with compound steam cylinders, as here shown, with the Blake automatic valve motion, when it is to be operated condensing, and with twin vertical steam cylinders when operated non-condensing and the exhaust steam utilized for feed water heating or otherwise. The advantage of the vertical construction is that all pistons wear equally on all sides, and not downward as in the horizontal type. The water cylinders are composition lined and all water piston (or bucket) heads are of the same material and fibrous packed. Easy access is afforded to heads, packing and water valves through hand holes on either side of the pump. A special composition is used in the construction of the water valve seats and guards and the studs and water piston rods are of Tobin bronze.

The injection stem and cone are of composition, access to the same being provided through hand holes on either side. The amount of water passing through the condenser is regulated by the vertical adjustment of the injection cone which acts as a nozzle to form a thin spray, which is thrown out at an angle of 45 degrees. This falls upon a succession of shelves, thus forming secondary spray through which the exhaust steam from the engine must pass; instantaneous condensation results with economy in the use of water. As the combined volume of injection water and condensed steam flows by gravity through the bottom of the condenser into the pump, it is arranged to prevent flooding of the cylinders of the main engine by an independent vacuum breaker attachment secured to the side of the condenser; this is so arranged that when the water reaches the level of the float chamber the float is raised, and by great leverage forces the check valve from its seat, allowing an inrush of air which instantly breaks the vacuum, thus preventing further suction of water into the condenser and consequent flooding of the engine. The construction of this machine is compact and simple, all parts are readily accessible.



A NEW TWIN COMPOUND JET CONDENSER.

The condenser shown in the accompanying illustration is a twin vertical compound jet condenser of exceptional size, having a capacity of 64,000 lbs. of steam condensed per hour with the injection water at 70 deg. F. It has steam cylinders 15 and 30 inches in diameter by 24 inches stroke, and the air cylinders are 38 inches in diameter. The injection inlet is 12 inches, while the discharge is a 20-inch pipe.

NEW QUARTERS FOR THE BOSTON SOCIETY OF CIVIL ENGINEERS.

A special meeting of the Boston Society of Civil Engineers was held on April 12, to consider the recommendation of the Committee on Quarters made in its report submitted to the society at the annual meeting, an abstract of which was published in The Engineering Record of March 25, and to act on the question of quarters. There were about 70 members present.

The report above referred to was that of the majority of the committee, and since it was made a minority report was presented. The matter of accepting the recommendations of the majority of the committee on quarters, provided suitable arrangements could be made, was very fully discussed, in which the following points were brought out:

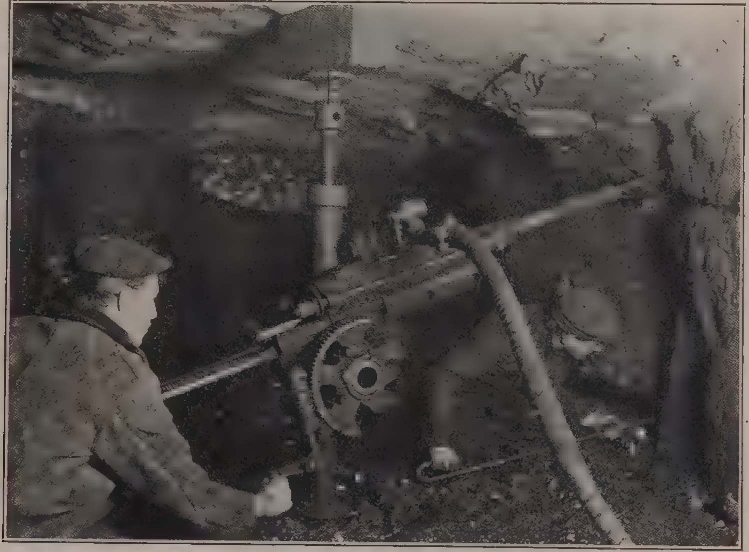
In favor of moving, it was stated that it would be a great advantage to the New England Water Works Association, sub-tenants of the Society, and to the Sanitary Section of the Society, to have rooms in a building where there is a hall and where arrangements might be made for serving refreshments, as both of these societies have dinners served previous to the presentation of papers at their meetings, necessitating holding their meetings in hotels; that the present quarters are inadequate, and that by moving the society would have better quarters and better accommodations.

As opposed to moving it was stated that the present location is the best that could be obtained, that the hall accommodations would be poorer in the proposed quarters, as it is designed to place the hall in the sub-basement with the floor at grade 0, so that the ventilation would be bad; besides, columns would interfere with its use; that the proposition of the Suffolk Real Estate Trust is extremely indefinite, and that proposed additions to the present quarters would provide shelf-room sufficient for from 10 to 12 years' growth of the library.

By a vote of 41 to 24 the Society voted against the acceptance of the report of the majority of the Committee on Quarters. The matter of renewing the lease of the present quarters with additional floor space was referred to the Board of Government with power to act.

THE INGERSOLL-SERGEANT RADIAL COAL CUTTER.

Machine methods have long held prominent place in the coal-mining field and the "puncher" or pick machine is a recognized factor in coal-mine economy. Years of experience with this machine have established its limits of usefulness, and the need of another machine to supplement or assist the puncher has long been acknowledged. The new radial coal cutter, recently placed on the market by the Ingersoll-Sergeant Drill Co., of New York, is designed to fill this need. While only lately brought before the public, this machine has for a long time been in severe experimental service in some of the largest producing coal mines in the country. It is designed especially for the work of shearing and entry driving. The idea of the radial mounting is not new, but as applied to the requirements of coal mining it is a distinct innovation.



A NEW COAL-CUTTING MACHINE.

A shearing machine to meet the conditions properly must be light, simple, durable and economical of power. It must also be capable of operating with economy of coal, i. e., it must break the coal without producing an unduly large percentage of the smaller sizes. In operation, the new cutter has shown itself fully capable of meeting these requirements. As an undercutting machine it is adapted for undercutting headings to any desired depth at a single setting. It will also shear either one or both of the sides of an entry, from the floor of the mine to the roof, to any desired depth at one setting. The drill or cutter being mechanically erected, all these operations are performed without any shock or jar on the operator. The machine is light, and easily and quickly moved and mounted, in this respect also appealing to the man who handles it.

The cut made by the cutter is 8 ft. in depth and diminishes from a width of 4½ in. at the face to about 2 in. at the bottom. The piston and chuck having a rotating movement, the machine can be used as a drill for putting in the holes preparatory to blasting the coal. This same fact is of value in permitting the use of the machine as a rock drill for "brushing" purposes; and the change from a rock drill to a coal cutter, or vice-versa, can be made in a moment of time. It can, therefore, be used advantageously in sinking shafts, driving tunnels in rock, drilling through spars, clay veins, "horse-backs," etc.

By its use entries can be driven, the makers claim, in less than half the time required by hand methods or any of the so-called entry-driving machines. Its application in the mine materially increases the percentage of lump coal, as well as adding to the output per miner. In mines where coal is blasted from the solid, this machine may be applied for shearing the rooms in the center, ready for blasting toward the center upon "open ends." Being mounted upon a plain vertical column, the radial cutter can be raised or lowered to undercut at any point between roof and floor, and readily applied to slate bands, layers of "black jack" and other impurities, leaving the coal mined clean.

COST OF LIGHTING IN NEW YORK.

The joint Legislative committee that has been investigating the cost of lighting in New York has submitted its report, which makes the following recommendations:

Price, Pressure and Quality of Gas.—From the evidence which has been presented the committee is satisfied that a price of 75 cents per 1,000 cu. ft. will be fair to the consumer, and will afford to the companies, after allowing the proper costs for manufacture and distribution, taking into consideration all the elements of such cost, a reasonable return upon their capital investment in their gas-making business. This applies to the borough of Manhattan, the borough of Brooklyn and a large part of the borough of Bronx. In the committee's opinion it would not be just to make such a rate applicable to the more sparsely settled sections of the City of New York, in which, owing to local conditions, the cost of manufacture and distribution is necessarily higher.

The investigation has shown clearly that by increasing the pressure a quantity of gas poorer than the standard required by law may be made to furnish a required degree of illumination, thus entailing increased consumption at an increased cost to the consumer. In order that the consumer may benefit by the reduction of the price of gas, it is important that the degree of pressure should be effectively regulated. The evidence has also shown that there is at present no official inspection in any borough of the city except Manhattan, and that the inspection in the last named borough is too infrequent to be adequate. The pressure of gas in any street main should not exceed 2½ in. or be less than 1 in.

Provision should be made for a system of inspection insuring a supply of pure gas in accordance with the legal standard and its accurate measurement at the meter. This inspection should be made by officials of the city at the city's expense.

The price to be paid for municipal gas lights should be left to the city officials to decide, the committee states.

Cost of Electric Current.—The committee is satisfied that electric current can be furnished for light, heat and power purposes at a maximum price of ten cents per kilowatt hour for the current actually consumed, and that this rate will permit a proper return to the companies over and above all elements of cost upon their actual investments in the business. The committee also thinks that there should be an adequate system of inspection, particularly of meters, so as to assure a charge only for the actual current furnished.

The charge for street-lighting lamps of the enclosed arc type, of 2,000 c.p., consuming 450 watts per hour, should not exceed $100, in the committee's opinion. The price of twin lamps, that is, two lamps suspended from a single post and consuming each 250 watts at the arc, should not exceed $65 each per lamp per year.

The committee is of the opinion that the city should be given authority to utilize water power, now owned or hereafter acquired by it, for the purpose of generating electric current for the use of the municipality, provided no additional water shall be used for such purposes than would otherwise be required by the city. There will be no difficulty in utilizing the water power of the city for the purpose of generating current for its use without increasing the total consumption of water by the city.

Control of Companies.—It is manifest, the committee states, that the conditions disclosed by the testimony make it necessary that the operations of companies supplying gas and electricity, as well as those engaged in other public service, should be the subject of constant and effective supervision by a body paid by the State and clothed with power to execute its orders, subject to suitable review by the courts upon appeal. The gross abuse of legal privilege is overcapitalization and in the manipulation of securities for the purpose of unifying control and eliminating all possible competition, the committee says, shows clearly that there can be no effective remedy by general legislation or through ordinary legal proceedings, and that for the protection of the public there should be created a commission with inquisitorial authority, competent to make summary investigations of complaints, to supervise issues of securities and investments in the stocks and bonds of other companies, to regulate rates and to secure adequate inspection; and otherwise to enforce the provisions of law.

The history of the subway companies is cited as affording an apt illustration of the futility of carefully phrased contracts, executed in pursuance of express legislation, in the absence of an effective scheme for regulation. The failure of general provisions prohibiting the consolidation of corporations is conspicuously shown, the committee says, by the manner in which the provisions of the charter of the New York Mutual Gas Light Co. and the act of 1886 regarding the Standard Gas Light Co. have been evaded. The investment of millions in securities earning no dividends and intrinsically worthless, solely for the purpose of securing monopoly control, points to the necessity of strict supervision in this regard.

The commission accordingly recommends to the Legislature the passage of a bill for the creation of a commission, the members of which should be appointed by the Governor, with the consent of the Senate, to be paid by the State and to have general supervision of all persons and corporations having authority to lay or erect and maintain wires or pipes for the purpose of furnishing gas or electricity for light, heat or power, with power to investigate and ascertain the character of the service and reasonableness of charges, and the methods employed in manufacture and distribution, and in the maintenance of the works and distributing systems and to enforce the provisions of law applicable thereto; to prescribe methods of keeping accounts; to examine the corporations under its supervision; to require annual reports; to examine books and papers and compel their production; to subpœna witnesses and to take testimony; to supervise issues and increases of securities, investmentments in the stocks or bonds of other companies and and transfers of franchises, and to regulate rates within the limits prescribed by law. It should be provided that the orders of said commission on confirmation by the Supreme Court at special term should be enforcible by punishment for contempt in case of disobedience.

GASOLINE ENGINES IN CHINA.

By George E. Anderson, U. S. Consul, Hangchau.

Labor is so cheap in China and the cost of installing a power plant is comparatively so much that there is reluctance on the part of Chinese manufacturers to introduce power, even where it is evident that they could do so with considerable saving of labor and eventually of money. Under the present cheap-labor system of doing things there is no outlay for high-priced machinery, and the result is that if for any reason an establishment is shut down there is no loss to follow the idleness of money invested in a power plant.

The "fung shuey," or doctrine of the "wind spirit," and "good luck" has also a direct bearing upon the situation. It is believed that tall smokestacks and high buildings will interfere with this "wind spirit" and bring bad luck, and it is safe to say that no ordinary attractions of investments will lead the average Chinese business man into doing anything to conflict with his belief.

There is a growing conviction of the advantage of power plants in the larger concerns, and the number of mills with fair-grade power plants is increasing. It will be only a matter of a short time until the smaller manufacturers come to appreciate the need of power, and when that time comes there will be a field for gasoline engines almost beyond conception in its scope. As in the United States, there will be many cases and places where steam power will be preferable, but there are already many chances for the introduction of gasoline or naphtha power. Such engines are put out cheaply, and can be made cheaply and strongly enough to meet the requirements of a market where there is an absolute lack of knowledge of such machinery and its practical operation.

American manufacturers must remember in this connection that while they have the advantage at the present time there is reason to believe that before long they will have to fight for this trade with every weapon known to the modern business world. Already Japanese manufacturers are commencing to make some machinery of this sort, and while it lacks the merit of the American product, and will always be more or less behind the latter, it by no means follows that it will not be readily accepted in China. The Japanese have iron, coal and other raw materials and industrial necessities. They have American and European trained experts, and they have labor so cheap that American competition on a labor basis is impossible. It behooves American manufacturers to get into the market in China with machinery of all kinds if they expect to hold these markets in the future.

The power machinery for most mills in this portion of China is from England or Scotland. As a rule, the mills have been established with English capital or under English auspices, and, naturally, the machinery has been bought in the United Kingdom. At the present time, other things being equal, American power is likely to be sought for, but where the margin between the machinery of several nations is as narrow as it is, it can hardly be expected that the Chinese market will do much running after the goods of any one of them.

So far as gasoline engines are concerned, a few object lessons out here would do a world of good, and I believe that there will be an immediate demand for such machinery when its cheapness, convenience and efficiency are known.

AN ADJUSTABLE PIPE-BENDING MACHINE.

The accompanying engraving illustrates a pipe-bending machine which consists of a revolving grooved quadrant block in which the section of pipe to be bent is clamped by means of a U-shaped clip, and an adjustable guiding roll, by which the pipe is bent as shown. Sufficient adjustment of the roller is provided to enable almost any combination of sharp or easy bends to be made. It is capable of bending any size of pipe up to 2 in., the leverage secured through the large hand wheel and quadrant gear making the bending of the larger sizes easy.

It is mounted on a light stand so as to be portable, and thus adapted to temporary installation work. Special brackets may also be used for attaching the machine to columns or posts. While the bender is particularly adapted for pipe, either uncoated or coated by the Sabin process—or galvanized—without breaking the coating, still it may, by means of special quadrant dies and roller guides, be adapted to the bending of shapes in structural steel, such as light angles, tee-bars, etc. The machine has been placed on the market by Pedrick & Smith, 226 East Girard St., Philadelphia, Pa.

TEST OF A PUMPING ENGINE AT PEABODY, MASS.

Tests of a triple-expansion horizontal duplex Worthington pump, in which all the steam cylinders are jacketed with live steam at boiler pressure and reheaters are employed between the high and the intermediate and low pressure cylinders, were conducted on June 18 and 20 of last year at Peabody, Mass., by Messrs. Snow & Barbour, of Boston. The pump exhibited a capacity of some 5,672,000 gal. of water, against a total head of 164 ft. on a duty of 134,607,534 ft.-lb. per 100 lb. of dry coal. In all three particulars the conditions were in advance of those specified, the required capacity being 5,000,000 gal. in 24 hours, against 160 ft. total head, and the duty guaranteed by Henry R. Worthington being 130,000,000 ft.-lb. An interesting feature of the installation is an accumulator system designed to perform the functions of a flywheel in distributing the power applied equally throughout the entire length of the stroke.

The pump is 12x20x34x18x24 in. in cylinder sizes. The jacket water is drained to a tank and is returned to the boiler by a 3x2x3-in. pump. A surface condenser of 228 sq. ft. of surface is used in the main suction pipe and a duplex air pump, with 9-in. plungers and 6-in. stroke, driven by the main engine, delivers the water of condensation to the sewer. The exhaust from the low-pressure cylinders passes first through a closed heater of 30 sq. ft. of heating surface, which receives the boiler-feed water from the delivery main. The water then goes to a 4½x2¾x4-in. feed pump and thence through a 15 sq. ft. closed heater, heated by the exhaust from the feed pump, the air compressor and the jacket pump, to the boilers.

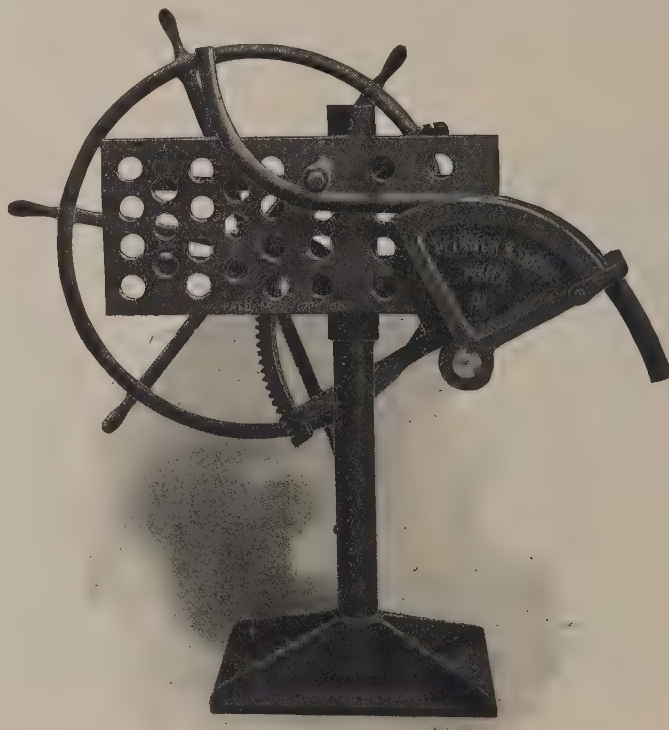
The suction pipe to the pump is 24 in. in diameter. The pump well is located immediately below the engine-room floor. The force main is 20 in. in diameter and runs a distance of 850 ft. to a point where one branch, 20 in. in size and 3,000 ft. long, leads to a storage reservoir, with maximum high water at El. 220, or 142 ft. above the engine-room floor, while the other branch connects with the distributing system of the town.

The high-duty attachment comprises an accumulator having an air cylinder 17¾ in. in diameter and a water plunger 4¼ in. in diameter, both 30-in. stroke, four compensating cylinders with 4¾-in. plungers, a duplex pump, with ¾-in. plunger and 4-in. stroke, driven by the main engine and a 9½-in. air compressor.

The boiler plant consists of two 100-hp. Stirling boilers, with Niclausse superheaters. The superheater is designed to superheat 100° above the temperature due to a pressure of 150 lb. Each boiler contains 990 sq. ft. of heating surface and 28 sq. ft. of grate surface. The New England roller grate is used, 4 ft. wide and 7 ft. long.

The contract prescribed that the test should extend over two days and that the engine should be operated ten hours each day, a different boiler being used each day. The principal object sought, it was emphasized in the report, was the weight of the coal consumed during the operation of the pumping engine, and owing to the many variables entering into the trial, partly on account of their relatively short duration, the results of the boiler performance are not regarded as of scientific value.

In the boilers an average of 253.76 lb. of dry coal were consumed per hour, the total amount consumed being 2,380 lb., having 0.94 per cent. moisture, and the rate of combustion was 8.42 lb. of dry coal per square foot of grate surface per hour. The interesting fact was brought out that there was a loss in pressure of steam between the boiler and the engine of 1.1 lb. and 3.12 lb., respectively, for the first and second day's trial. The average boiler pressure was 156 lb. by gauge and the temperature of the steam was 423°, and that of the escaping gases 422°. With an external air temperature of 73.4° and a fireroom temperature of 94°, a draft of 0.242 in. of water was maintained by a chimney 100 ft. high and 39 in. in diameter, with 42-in. boiler flue connecting to it. The feed water temperature was 192°.



MACHINE FOR BENDING PIPE AND LIGHT STRUCTURAL SHAPES.

As regards the pump test proper, the water was pumped, on the first day, into the distributing system and allowed to overflow into the reservoir, and on the second day was delivered to the reservoir, which was used as a measure of the capacity of the pump. The average length of stroke was 24.62 in., the total number of single strokes was 88,124, and the displacement per revolution of the engine was 14.303 cu. ft. The total head pumped against was 163.989 ft. A comparison between the pumpage, as indicated by plunger displacement with the measurement at the reservoir, over 8 hr., showed a slip of 1.51 per cent. With these data it will be found that the duty figures out at 134,607,534 ft-lb. per 100 lb. of the dry coal.

WINDMILLS FOR SOUTH AFRICA.

Owing to the continued dry seasons in South Africa, which have caused the destruction of large droves of cattle, a large demand for pumps and windmills has sprung up, according to U. S. Consul Monaghan. The sinking of wells has become a pronounced necessity. Even the government boring machines have been called into use to supply cattle with the necessary quantity of water to sustain life.

Two kinds of motors are salable: a light one for pumping water for cattle and a heavier one to pump for irrigation purposes. Of the first kind there is a great variety on the market at Cape Town. The main points considered in purchasing such motors are lightness combined with great capacity, facility of removal from one place to another and ability to be set in motion by the lightest breeze. Windmills answering these conditions are at the present time very scarce. It is conceded that the American-built windmills are by far the best. German and Austrian manufacturers, however, are doing all in their power to get control of the South African market. It behooves our manufacturers, therefore, to give strict attention to this market if they wish to hold it. Care should be given to the packing and shipment of goods. Duplicate parts must be at hand so that broken machinery can be repaired at short notice. This is a point to which German manufacturers give special attention.

BUSINESS NOTES.

Julian Scholl & Co., New York, have incorporated with a capital of $150,000. The incorporators are H. T. Miller, Paterson, N. J.; John J. Boland, Brooklyn, and Wm. R. Boenke, New York City.

The Terry & Tench Co., Lexington Ave. and 131st St., New York, is building in its structural shops the 700-ton steel framework for a five-story schoolhouse in Brooklyn, and different portions of the steel structural work for the Rapid Transit power-house at West 59th St. The company is erecting four 140-ton steel shields, 23 ft. in diameter and 18 ft. long, in the east and west ends of the two North River tunnels of the Pennsylvania R. R. terminal improvements. It is also erecting at Christopher St. a similar 45-ton shield, 15 ft. in diameter and 13 ft. long, for the Hudson River tunnel. It has just finished the erection of about 1,600 tons of elevated railroad structure for the West Farms yards of the New York Rapid Transit R. R. and is erecting the 50,000 tons of steelwork for the New York Central & Hudson River R. R. terminal improvement in Park Ave. This company has a large business in supplying derricks fitted with Terry's patent head and foot blocks and boom irons. Among recent orders for stiff-leg derricks are two of 10-tons capacity for Butler Bros., for the New York Central & Hudson River R. R. power-house at Yonkers; one 7-ton derrick for Isaac Hopper & Son, for the Edison power-house at 37th St. New York; one 7-ton derrick for S. Pearson & Son, for use at the Brooklyn end of the East River tunnel; one 7-ton derrick for Curtis & Tribble's stone-crushing plant, New York; two 7-ton derricks for D. D. Streeter, for use on the New York Central & Hudson River R. R. cut-off at Spuyten Duyvil; one 3-ton derrick for the Youdelman & Co. foundry at Greenpoint, N. Y.; one 7-ton, 45-ft. boom for Seely & Taylor at New Rochelle, N. Y.; three 7-ton derricks for Lidgerwood Mfg. Co., for shipment to Canada; one 1-ton derrick for Lidgerwood Mfg. Co., for shipment to France; four 7-ton, stiff-leg, hand-power derricks, four 7-ton, hand-power, guyed derricks, and three 7-ton, stiff-leg derricks with steam power for the Lidgerwood Mfg. Co., for shipment to Brazil; three 7-ton and three 10-ton derricks for the Lidgerwood Mfg. Co., for export; one 20-ton guyed derrick with 60-ft. boom for Jobson & Hooker, for use on the East River tunnel shaft caissons; two steel guyed derricks with 80-ft. masts and 70-ft. booms for the Astoria Veneer Mill Co., Astoria, N. Y.; one traveler with two 5-ton, stiff-leg derricks with 40-ft. booms for the O'Rourke Engineering Construction Co., for handling materials in the yards of the North River tunnel; two 5-ton derrick cars with 34-ft. booms for D. D. Streeter, for work on the New York Central & Hudson River R. R. Co., at Schenectady, and one derrick car with a 5-ton, 40-ft. boom for dry dock No. 4 at the U. S. Navy Yard, Brooklyn, N. Y.

The B. M. & J. F. Shanley Co. has moved its Philadelphia office to room 400, Arcade Building.

The offices of Mr. R. H. Reed, sales manager of the Reeves Engine Co., have been moved to the Singer Bldg., 85 Liberty St., New York.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., sailed on April 18 for a five weeks' trip to Europe. He took five styles and sizes of electric drills for demonstration purposes. The company's business has been very large lately, both in the United States and abroad.

The Dayton Pneumatic Tool Co. has been incorporated in Ohio with a capital of $50,000, for the purpose of manufacturing pneumatic tools and all kinds of air appliances. This company has taken over the business of the Chicago Tool & Supply Co., and will manufacture the "Green" pneumatic hammers in their own factory at Dayton, where their principal offices will also be located.

A new company has been formed in Pittsburg known as the Golden-Anderson Valve Specialty Co., with offices at 105 Pike St., for the manufacturer of steam and water valves, steam traps, boiler blow-off cocks, and other specialties. The Anderson cushioned non-return valve, of which there are three types, is already well known. It has an outside dashpot playing loosely on the valve spindle and cushioning in the body of the valve beneath the bonnet, and an inside dashpot attached to the disc spindle. When the pressure of the steam in the boiler raises the valve disc it comes in contact with the outside dashpot, and carries that upward also; then as there is the same amount of space for the valve disc to lift before the outside dashpot is raised as there is between the inside and outside dashpots, a cushioning is formed which prevents the chattering and pounding of seats. The Golden tilting steam trap is another well-known specialty. The Anderson balanced plug cock for boiler blow-offs has a roller lock by which the pressure with which the conical plug is forced into its seat is partially released in opening; this tends to greatly reduce the scoring and wear that would otherwise occur upon the seat. The company will also supply a complete line of automatic valves and water columns for railroad service. Mr. C. E. Golden, president of the company, has been in the valve and steam specialty business for the past 15 years.

The Hewitt Motor Co., New York, has been incorporated with a capital of $100,000. The directors are E. R. Hewitt, Erskine Hewitt and C. O. Snyder.

The Riter-Conley Mfg. Co. has removed its New York office to the Trinity Bldg., 111 Broadway.

The Miller-Collins Co., 1133 Broadway, New York, recently incorporated by S. Fischer Miller and D. C. Newman Collins, has been awarded the general contract for the new factory building of Hanan & Son, in Brooklyn, N. Y., H. S. Kissam, archt., 156 Fifth Ave. The building is to be 5 stories, basement and sub-basement, 200 x 100 ft., of reinforced steel concrete construction, brick exterior walls.

The plant of the Driggs-Seabury Ordnance Corporation, Sharon, Pa., is about completed, consisting of a 100 x 440-ft. foundry building, 109 x 160-ft. forge shop, 60 x 260-ft. machine shop, 40 x 180-ft. power house and 60 x 260-ft. shell building; all of steel frame construction. They were designed, manufactured and erected by Wm. B. Scaife & Sons Co., Pittsburg, Pa.

The Toledo-Massillon Bridge Co., of Toledo, O., has been organized to succeed the Massillon Bridge Co. The board of directors elected consists of the following: Thomas H. Tracy, C. A. Peckham, C. S. Davis, J. J. Swigart, Clarence Draper, Christopher L. Gates and J. K. Secor. The officers of the company are: Pres., Thomas H. Tracy; Vice-Pres., J. J. Swigart; Sec. and Treas., C. A. Peckham, and Chief Engineer, C. S. Davis. It is expected to build a new plant at Toledo in the near future.

The Snare & Triest Co., contracting engineers for steel and masonry construction, has changed its New York headquarters from 39 Cortlandt St. to 143 Liberty St. The company's Havana offices are at Mercaderes 11.

The two largest municipal pumping engine contracts that have probably ever been placed have just been awarded to Allis-Chalmers Co. One is from New Orleans for half a million dollars, and the other is from Pittsburg for $350,000. For New Orleans there will be built a complete pumping plant taking water from the Mississippi River, lifting it first to settling basins, and finally distributing it throughout the city under pressure. For the preliminary lifting there will be three Allis-Chalmers horizontal cross-compound engines direct-connected to centrifugal pumps of 40,000,000-gal. capacity each. The high-duty pumps will be of 30,000,000-gal., each, of the vertical triple-expansion crank and flywheel type. There will also be supplied one 20,000,000-gal. centrifugal pump and one horizontal cross-compound Reynolds-Corliss engine, as well as a 150-kw. direct-current Bullock generator direct-connected to a horizontal cross-compound Reynolds-Corliss engine. The Pittsburg pumping station will be supplied with two vertical compound crank and flywheel pumping engines capable of pumping 30,000,000 gal. daily against a head of 360 ft. This station will also be supplied with four centrifugal direct-connected pumping units, each pump to have a capacity of 35,000,000-gal. per day against a 45-ft. head. The Allis-Chalmers Co. will also supply the Pittsburg pumping station with the auxiliary machinery.

Following closely upon the expiration of some of the Tesla polyphase patents, on May 1, the Westinghouse Electric & Manufacturing Co. has issued a notice calling attention to numerous other patents relative to polyphase induction and synchronous motors, dating from Dec. 3, 1889, to May 4, 1904, which it proposes to protect from infringement in the future as in the past. Twenty-four patents in all are enumerated, among them many of the most important of the Tesla patents, and patents to Stanley, Hutin and Leblanc, Lamme, Nolan and Dusinberre, covering various features of alternating current systems.

The Canadian Westinghouse Co., Ltd., recently sold to Edmonton, Alberta, Street Railway Co. a 200-kw. railway generator and a number of double equipments of railway motors. Another recent sale was a 500-kw. enclosed type turbo-generator unit to the Canadian Pacific Railway Co., to be installed at Fort William for supplying power to grain elevators. The unit is to operate three-phase, 600 volt, 7,200 alternations, 3,600 r.p.m.

The Parson Mfg. Co. has removed its offices to more commodious quarters at 299 Broadway, New York.

The New York office of the Ashton Valve Co. has been moved to 128 Liberty St., where a stock of pop safety valves, gauges and other specialties will be carried.

PERSONAL NOTES.

Mr. A. F. Gill has resigned as city engineer of Spokane, Wash.

Mr. Frank B. Gridley has been appointed assistant city engineer of Troy, N. Y.

Mr. William Tod, president of the William Tod Co., of Youngstown, O., died April 27.

Mr. W. H. Purdy, assistant chief engineer of the Wabash-Pittsburg Terminal Ry., has resigned.

Captain Robert P. Johnston, Corps of Engineers, U. S. A., has been transferred to Washington Barracks.

Mr. W. S. Murray has been appointed electrical engineer of the New York, New Haven & Hartford R. R.

Mr. Alfred S. Burgess has been appointed assistant engineer by the Aqueduct Commission of New York City.

Mr. Mason R. Strong, bridge engineer of the Erie R. R., has been appointed engineer of bridges and buildings of that road, effective May 1.

Mr. Philo Holbrook, Jr., assistant engineer in the U. S. Reclamation Service, has been assigned to work under Mr. T. A. Noble at Spokane, Wash.

Mr. J. O. Burrage has been appointed assistant engineer in the U. S. Reclamation Service and assigned to duty under Engineer J. E. Field at Denver, Col.

Mr. James C. Meem will present a paper on "Some Recent Methods of Tunneling in Soft Ground" before the Brooklyn Engineers' Club on the evening of May 11.

Mr. W. S. McGowan, Jr., has been appointed Eastern sales manager of the American Brake Shoe & Foundry Co., with headquarters at 170 Broadway, New York City, after May 1.

Mr. H. G. Hunter, of the engineering staff of Snow & Barbour, of Boston, Mass., has been appointed resident engineer in charge of water works extensions in St. John, N. B.

Mr. Roderick McKay has been appointed by the city council of Los Angeles, Cal., to visit various Eastern cities and investigate the methods of garbage disposal employed by them.

Mr. W. J. Crocken has been reappointed city engineer of East St. Louis, Ill., and Messrs. W. A. Thompson, George H. Meck and P. B. Leivey have been appointed as assistant city engineers.

Mr. George H. Stroebe, of Michigan, has received an appointment as engineering aid in the U. S. Reclamation Service and will be engaged at Bismarck, N. D., under Mr. James E. French.

Mr. Joseph L. Bayne has been appointed assistant engineer in charge of pavement in Cleveland, O., to succeed Mr. Myron B. Vorce, who was recently appointed building inspector in Cleveland.

Mr. Ernest McCullough has resigned as engineer of the Municipal Engineering & Contracting Co., Chicago, and may open an office for private practice in Chicago, making a specialty of concrete work.

Mr. Charles A. G. Winther, who recently resigned as general superintendent of the Chapman Valve Mfg. Co. at Indian Orchard, Mass., has been engaged as consulting engineer to the American Woven Leather Belting Co., of Springfield, Mass.

Mr. Olaf Hoff has resigned as engineer of structures of the New York Central & Hudson River R. R. and has been elected vice-president of the Butler Bros. Construction Co., 1170 Broadway, New York City.

M. Guerard has been designated by the French Government as the French member of the board of consulting engineers to the Isthmian Canal Commission. M. Guerard was formerly chief engineer of the Marseilles harbor and is now inspector-general of roads and bridges in France.

Messrs. C. E. Bryon and C. E. Shields have formed a partnership under the firm name of The Concrete Construction Co., of Rock Island, Ill. The engineering department of the firm will be in charge of Mr. Bryan, who has had a wide experience in city and Government construction work.

Mr. M. A. Neeland, general manager of the William Tod Co., of Youngstown, O., has resigned to accept a position as assistant to Mr. John Reis, who was recently appointed assistant president of the United States Steel Corporation. Mr. Neeland will be engaged in construction engineering work.

Mr. Glen D. Holmes, of Batavia, N. Y., has been appointed engineer in charge of water supply for the New York State barge canal, with headquarters at Rome. Mr. Holmes has been connected in engineering capacities with the improvements to the Erie Canal, the construction of the water filtration plant at Philadelphia, the United States deep waterway improvements at Detroit and on New York additional water supply work.

Mr. C. E. Grunsky, consulting engineer, U. S. Reclamation Service, has started on an extended trip through the Northwest. As personal adviser of the Director of the Geological Survey, Mr. Grunsky will devote considerable time in Montana in investigation of the international questions involved in the Government's irrigation project in the Milk River Valley. Later he will proceed southward, visiting in turn several projects in Wyoming, Colorado, New Mexico and Utah.

Mr. Morris R. Sherrerd, engineer and superintendent of the water department of Newark, N. J., has been temporarily placed in charge of the engineering work of the street department as well. As soon as the by-laws of the Board of Street and Water Commissioners can be legally changed so as to provide for the position of chief engineer to the Board, Mr. Sherrerd will receive the appointment. The office will carry with it the administrative control of the water, street and sewerage work of the city, under the direction of the Board.

William C. Hubbard, for several years with the Westinghouse Electric & Mfg. Co., has severed that connection to enter the sales department of the Cooper-Hewitt Electric Co., New York. Mr. Hubbard was associated with Prof. L. B. Marks in the introduction of the first commercial enclosed arc lamp in this country. For two years he was vice president and general manager of the Electric Arc Light Co., and afterwards New York manager of the Manhattan General Construction Co. until both companies were absorbed by the Westinghouse interests.

Major Walter L. Fisk, Corps of Engineers, U. S. A., has been assigned to duty in the Philippines to relieve Major Harry Taylor, Corps of Engineers. Major Fisk graduated from the U. S. Military Academy with the class of 1877 and then spent three years at the U. S. Engineer School at Willets Point, N. Y. His first appointment was in local charge of harbor and river improvements in Florida in 1880 and from that time until 1892 he was in charge of various hydrographic and construction work in the South and Middle West, excepting two years which he spent as assistant professor of civil and military engineering in the U. S. Military Academy. From 1892 to 1895 he was in command of a battalion of engineers, and instructor in electrics and torpedo service in the U. S. Engineer School at Willets Point, N. Y. After that he was for some time in charge of defensive works at fort and river and harbor improvement in Oregon and Washington and more recently has been engaged in work on the Great Lakes.

Mr. John F. Stevens, second vice-president of the Chicago, Rock Island & Pacific Ry., has resigned to devote his attention to private business and will be succeeded by Mr. H. U. Mudge, who has resigned as general manager of the Atchison, Topeka & Santa Fé Ry. Mr. Stevens began railroad service in 1876 in the engineering department of the Sabine Pass & Northwestern Ry., and from that time until he was appointed principal assistant engineer of the Great Northern Ry. in 1890, he was engaged in various engineering positions on Western railroads. He became chief engineer of the Great Northern Ry. in 1895 and resigned from that position in 1898 to engage in railway contracting. He was reappointed chief engineer of the Great Northern Ry. and allied lines in 1899 and resigned later to accept the position which he has just vacated. Mr. Mudge entered the service of the Santa Fé in 1872 and gradually rose in the operating department until he was appointed general manager of that road in 1900. In his new position he will have charge of track and property improvements.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—Bids will be received May 15 by R. S. Williams, City Treas., for constructing a steel stand pipe; also same date for constructing foundations for air compressor, pumping engine and making changes in and to the pumping station.

Yuma, Ariz.—Bids will be received at the office of the U. S. Reclamation Service, Los Angeles, Cal., on June 5 (readvertisement) for the construction of the Laguna dam and sluiceways for the diversion of part of Colorado River about 10 miles from Yuma, as advertised in The Engineering Record. For list of detail bids received previously on this work, see issue of The Engineering Record Mar. 25.

Ventura, Cal.—It is reported that the Mound Water Co. has applied to the Bd. Superv. for a franchise to construct, lay and maintain pipe and pipe lines for water distribution in this county; and bids for said franchise to be received until June 8; Geo. E. Farrand, Co. Clk.

Covina, Cal.—E. H. Lahee, Pres. Bd. Trus., writes that the matter of constructing a storage reservoir near San Dimas is being investigated. No plans as yet.

Ventura, Cal.—See "Power Plants, Gas and Electricity."

Tahoe, Cal.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Hazen, Nev., on June 15, for construction of outlet and controlling works and bridge at Lake Tahoe, Tahoe City, as advertised in The Engineering Record.

Boulder, Colo.—Eugene Wilder, City Clk., writes that the citizens on Apr. 4 voted to issue $75,000 bonds for improving the water works. Jas. P. Maxwell, City Engr., will have charge of this work.

New Britain, Conn.—The Water Comrs. are reported to be in favor of the gradual introduction of a meter system.

Hartford, Conn.—At a meeting of the Water Bd. Apr. 27 two possible new sources of water supply were considered; one is Riggs' Brook, the other a brook a short distance from reservoir No. 4. The Bd. also discussed the filtration of the whole supply by means of a plant below the distributing reservoir. No definite action was taken.

Danbury, Conn.—The City Clk. writes that the city proposes constructing a reservoir to cost about $200,000. Nothing definite has yet been done.

Wilmington, Del.—The following are the bids opened by the Water Dept. May 1 for water pipe:

(*a*) 3,640 tons 48-in. pipe, (*b*) 2,460 tons 42-in. pipe, (*c*) 14 tons specials (price given per ton): R. D. Wood, Philadelphia, Pa., *a* $23.60; *b* $23.60; *c* $48. United States Cast Iron Pipe Co., New York, N. Y., *a* $24.40; *b* $24.40; *c* $54.40. T. A. Gillespie & Co., New York, N. Y., *a*, *b* and *c*, $25.50.

Riveted steel pipe: 11,120 ft. of 48 or 49-in. and 9,500 ft. 43-in. Bidders submitted different bids on each class of pipe, according to the thickness per ft., as follows: (*a*) 48-in., (*b*) 43-in., (*c*) 49-in., Carroll-Porter Boiler & Tank Co., Pittsburg, Pa.: ¼-in. thick, *a* $4.90; *b* $4.30; *c* $4.95; 5/16-in., *a* $5.50; *b* $4.90; *c* $5.55; ⅜-in., *a* $6.20; *b* $5.50; *c* $6.30; ½-in., *a* $7.65; *b* $6.75; *c* $7.70; ⅝-in., *a* $9.10; *b* $7.97; *c* $9.20. T. A. Gillespie Co., New York, N. Y., ½-in. thick, (*b*) $7.10; ⅝-in. (*b*) $8.60. This company also bid on locking bar pipe, 5/16-in. thick, *b* $5.25; ⅜-in., *a* $6.75; *b* $5.75; 7/16-in., *a* $6.90; *b* $6.10; ½-in., *a* $7.45; *b* $6.35.

Liveoak, Fla.—It is reported that the City Treas. will receive bids until May 30 for $36,000 water works bonds.

Sullivan, Ind.—The Sullivan Water Works Co. is reported incorporated to construct and operate water works; capital, $75,000. C. J. Sherman, A. D. Scott and J. K. Smock are the directors.

Princeton, Ky.—The City Council is reported to have adopted the report of Granberry Jackson, of Nashville, Tenn., for a water supply for Princeton, from wells; the estimated cost of the work, including a distribution system, etc., will be about $34,000.

Chicago, Ill.—Bids will be received May 20 by the Dept. Pub. Wks. (Wm. L. O'Connell, Deputy Comr.) for furnishing and delivering at Montrose Boule. and the north branch of the Chicago River c. i. flanged water pipe, bolts and washers.

The following are reported to be the bids opened on Apr. 26 for two boilers and a 3,000,000-gal. engine for the Washington Heights pumping station: Platte Iron Wks., $18,455; Laidlaw, Dunn, Gordon & Co., $19,858; Snow Steam Pump Works, $21,227, and Allis-Chalmers Co., $19,300.

Bids will be received May 10 by the Bd. Pub. Improv. (And. M. Lynch, Pres.) for constructing water supply pipe in numerous streets.

Moline, Ill.—City Engr. T. D. Wheelock, in the annual report on water works, is stated to have recommended the purchase of a site on the bluff for a reservoir and pumping station, a new intake pipe to the main channel and the installing of water meters.

Albia, Ia.—C. A. Rees is reported interested in the construction of water works.

Boyce, La.—The citizens are reported to have voted Apr. 25 to construct water works.

Baltimore, Md.—Mayor Timanus has signed the ordinance appropriating $60,000 from the Western Maryland funds for work to be done by the Water Dept. in the new district.

Lawrence, Mass.—A promising supply of driven well water has been found at Frye Village, a suburb of Lawrence, which will probably be used in place of an additional filter for an auxiliary water supply for the city. From 75 to 100 wells will have to be driven, a pumping plant installed and about 6,500 ft. of pipe laid to connect with the city mains.

Brockton, Mass.—Chas. R. Felton, City Engr., has been requested to report on a high-pressure water system.

**Hadley, Mass.*—Engrs. E. C. and E. E. Davis, of Northampton, write that the following are the totals of bids opened on Apr. 26 for water works construction at Hadley:

Water pipe, Fox & Co., New York, N. Y., $21,957 (contract awarded); R. D. Wood, Phila., Pa., $22,071; M. J. Drummond & Co., New York, N. Y., $22,263; U. S. Cast Iron Pipe & Fdy. Co., Philadelphia, $22,335; Chas. Millar & Son, Utica, $22.417; Warren Fdy. & Machine Co., Phillipsburg, N. J., $23,241.

*Pipe laying: Lane Constr. Co., Meriden, $9,144 (contract awarded); Wm. Orlando, Belchertown, $9,233; Crosby & Parker, Brattleboro and Boston, $9,490; E. B. Roberts, Boston, $9,505; Hendrick & Ryan, Easthampton, $10,045; Bruno & Milano, Boston, $10,177; Flynt Granite Co., Monson, Mass., $10,869; Mr. O'Dea, Cohoes, N. Y., $11,188; Booth & Co., Boston, $12,051; O'Connell & Son, Holyoke, $13,622; F. T. Ley & Co., Springfield, $14,532; Jas. Newman, Providence, $14,968, and E. N. Lyman, Ware, $39,497. The Flynt Granite Co., Monson, secured the contract for dam construction at $2,850.

Springfield, Mass.—Allen Hazen, of New York, N. Y., in his report to City Council, May 2, declares the project of taking water from Little River as feasible and that the opportunities for storage of water are favorable. A system having a capacity of 15,000,000 gal. daily, he estimates, could be constructed for $1,827,000, with an added $350,000 if it is desired to filter the water. He advises that the city do not build the big dam at the top of the gorge at once, as provision could be made for the present by raising two ponds upon the watershed to a height of 25 or 30 ft. and afford an adequate water supply for some years to come.

Detroit, Mich.—The State Senate is reported to have passed the bill authorizing the Water Bd. to expend $11,000 to extend water mains from city limits to the fair grounds.

Ada, Minn.—It is reported that bids will be received May 16 by the Village Recorder for furnishing and laying water mains.

Comfrey, Minn.—There is reported to be talk of constructing water works here.

West Duluth, Minn.—Local press reports state that the City Engr. will be asked to prepare plans and specifications for a reservoir in Lloyds addition, West Duluth, to have a capacity of 10,000,000 gal.; probable cost of work, $40,000.

**Whitebear Lake, Minn.*—The Allen-Black Co., of St. Paul, is reported to have secured the contract for constructing water works for $10,600 (bids opened Apr. 24).

Ely, Minn.—The Council is reported to be considering the securing of an additional water supply.

Lumberton, Miss.—Bids will be received by the Mayor and Bd. of Aldermen on May 17 for constructing a complete system of water works, as advertised in The Engineering Record.

Jackson, Miss.—The City Council is reported to have decided in favor of municipal ownership of the water works and will shortly begin negotiations with the Jackson Light, Heat & Water Co., with a view to purchasing its plant.

**St. Louis, Mo.*—John F. McMahon secured the contract for laying c. i. pipe (bids opened Apr. 25) at the following detailed bid: 56,800 lin. ft. 6-in. pipe, 24 cts.; 21,800 lin ft. 12-in., 37 cts.; 3,800 lin ft. 20-in., 80 cts.; setting 190 fire plugs, ea. $8; furnishing 5,500 lbs. wrought iron, 4 cts., and taking up 500 lin. ft. 6-in. pipe, 3 cts.; total bid, $26,493. The U. S. Cast Iron Pipe & Fdy. Co., Chicago, Ill., bid for 410 ton of c. i. water pipe at $29.45 for 3-in., $27.45 for 6-in., $26.45 for 12-in., and $25.70 for 20, 30 and 36-in., and $58 per ton for 153 tons specials. The Bessemer Fdy. & Machine Co. bid for the special castings, $53.60 per ton.

New Madrid, Mo.—It is reported that bids are wanted until May 17 for furnishing and constructing a system of water works. Owen Ford, Engr., Security Bldg., St. Louis, Mo. W. H. Copeland, City Clk.

Miles City, Mont.—Bids are wanted June 15 for $10,000 water improvement bonds.

Waterville, Me.—The following are the bids opened on Apr. 29 for laying c. i. water pipe and appurtenances in Waterville, Winslow, Fairfield and Benton (Leonard Metcalf, Superv. Engr., 14 Beacon St., Boston, Mass), (*a*) Boylston Constr. Co., (*b*) Horace Purinton Co., (*c*) Nichols-Magee Constr. Co.:

	a	*b*	*c*
1,000 cu. yds. rock excav. 7 ft. deep	$4.00	$4.00	$6.00
50 cu. yds. rock excav. 7-14 ft. deep	6.00	8.00	10.00
Pipe laying.			
560 lin. ft. 12-in. pipe over the Waterville-Winslow bridge, including boxing, etc.	2.65	3.50	.62
840 lin. ft. 8-in. pipe over Fairfield-Benton bridge, including boxing, etc	2.45	2.40	.62
260 lin. ft. (10-in. flexible joint) pipe under Sebasticook River	12.50	15.00	25.00
2,500 lin. ft. 16-in.	.71	.80	.62
1,900 lin. ft. 14-in.	.55	.75	.62
27,000 lin. ft. 12-in.	.38	.58	.62
4,000 lin. ft. 10-in.	.35	.49	.62
19,000 lin. ft. 8-in.	.29	.40	.62
2,300 lin. ft. 6-in.	.25	.35	.62
15,000 lin. ft. old pipe taken out of trench and removed	.20	.17	.20
Reconnecting 650 old services to new pipe	2.00	1.85	5.00
800 lin. ft. granite block relaid	.30	.90	.30
50 cu. yds. Portland cement concrete	10.00	10.00	6.00
Total	$36,697	$46,698	$55,812

Huntley, Mont.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Billings, June 28, for the construction of pumping station, concrete culverts, etc., and 2 steel highway bridges, etc., along the line of canal, east from Huntley, as advertised in The Engineering Record.

Billings, Mont.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Billings, on June 28, for the construction of about 30 miles of canal, for the diversion of water from Yellowstone River, about 10 miles east of Billings, as advertised in The Engineering Record.

Havre, Mont.—Bids will be received until May 10 for furnishing material and installing a system of driven wells to provide a water supply for the city, consisting approximately of the following: 6,300 ft of 2-in. black wrought iron pipe, 96 2-in. well points, 96 2-in. straightway valves, 96 2-in. flange unions, tees, lumber, etc. C. W. Swearington, City Engr.

Lincoln, Neb.—City Engr. Campen is reported to be preparing preliminary plans for a reservoir to be constructed at Mockett well; it will be 190x60 ft. and 16 ft. deep, and will have a capacity of about 1,350,000 gal.

Concord, N. H.—Water bonds to the amount of $45,000 are reported sold.

Perth Amboy, N. J.—It is stated that bids will be received until May 10 by the Water Bd. for laying 1,540 ft. 6-in. water pipe. S. J. Mason, City Engr.

Orange, N. J.—The Common Council is reported to have petitioned the Essex County Park Comn. for permission to enlarge the present reservoir in the South Mountain reservation.

Brooklyn, N. Y.—Bids will be received May 17 (John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City) for the following: Furnishing, delivering and laying water mains and appurtenances in Hicks, Joralemon, Furman and Willoughby Sts.; tapping 20 and 30-in. water mains in service and hauling and setting 6-in. hydrants, service mains, fire hydrants and appurtenances in various streets in this Boro., and for furnishing and delivering pig lead.

Troy, N. Y.—Governor Higgins is reported to have on Apr. 28 signed the bill placing the water works and park departments under the control of Comr. of Pub. Wks. Casey, appropriating $450,000 for the completion of the Tomhannock water works extension, $200,000 for filtration plants if deemed necessary by the commissioner, and $150,000 for purchasing land for the enlargement of Prospect Park.

Lockport, N. Y.—At a meeting of Common Council, Apr. 24, the Niagara, Lockport & Ontario Power Co. was awarded the contract for furnishing the city with a water supply as authorized by the election, Jan. 5.

Niagara Falls, N. Y.—At a public hearing called by the Bd. of Pub. Wks. on Apr. 26 a resolution was adopted authorizing the City Engr. to prepare estimates for constructing complete water works, including a filtration plant, to supply the whole city with water for domestic use and fire purposes, contemplating the utilization of the present plant owned by the Niagara Falls Water Works Co., but leaving out of said estimate any provisions for paying for the plant of the company.

Oswego, N. Y.—Bids will be received by the Dept. of Water (F. W. Ormsby, Secy.), May 18, for two 2,500,000-gal. 3-stage centrifugal pumps, with necessary connections and suction pipes; also same date for furnishing two 250-h.p. water wheels, with necessary shafting, gears, etc., for the Lake water extension, both advertised in The Engineering Record.

Oswego, N. Y.—See "Power Plants, Gas and Electricity."

Cohoes, N. Y.—A. T. Kniffin, Supt. Water Comrs., writes that bids will be received on Monday evening, May 8, for one power pump and one centrifugal pump, each to be of 3,150,000 gal. capacity per ea. 24 hours Bidders to furnish their own plans and specifications.

Seneca Falls, N. Y.—The citizens are reported to have voted Apr. 27 to issue bonds, not exceeding $110,000, for the construction of water works.

Oneida, N. Y.—Bids will be received by the Bd. of Pub. Wks., May 12, for the construction of a dam for the proposed additional reservoir for the water works, as advertised in The Engineering Record.

Williston, N. D.—See "Power Plants, Gas and Electricity."

Cleveland, O.—Bids will be received by A. R. Callow, Secy. Bd. Pub. Service, May 16, for furnishing and delivering c. i. water pipe and special castings from 3 to 48-in., inclusive, as may be required by the Water Wks. Dept., during the year 1905, as advertised in The Engineering Record.

Columbus, O.—See "Power Plants, Gas and Electricity."

Cleveland, O.—Bids will be received May 15 by the Bd. Pub. Service (A. R. Callow, Secy.) for concrete foundations for temporary engine house and Worthington engine No. 4, at the Kirtland St. Pumping Sta.

Youngstown, O.—The Bd. of Pub. Wks. is reported to have decided to recommend to City Council the issue of bonds for extending the water mains to the outlying districts; probable cost of work, $30,000.

Piqua, O.—The Council is reported to have passed an ordinance providing for the issue of $65,000 water works bonds.

Columbus, O.—Chief Engr. J. Gregg and John H. Gregory, special expert in charge, have completed plans for the purification and softening plant. It will cost about $500,000, and have a capacity of 30,000,000 gal. daily.

Cincinnati, O.—Bids will be received June 2 by the Bd. Trus., Comrs. Water Wks. (Aug. Hermann, Pres.) for furnishing and erecting 2 vertical or horizontal compound pumping engines, each of 2,500,000 gal. capacity in 24 hours, and boilers adequate in capacity for the operation of the 2 engines and their appurtenances, at the Western Hills Pumping Sta.; estimated cost, $38,000.

Ontario, Ore.—Seymour H. Bell, of Sumpter, is reported to have secured a franchise to construct water works at Ontario.

Panama.—Bids will be received by the Isthmian Canal Comn. at Washington, D. C., May 27, for steam pumps,

**Items marked thus give the names of parties awarded contracts.*

pipe, pipe fittings, hydrants, water meters, etc., as advertised in The Engineering Record.

Quarryville, Pa.—The American Pipe Co., of Philadelphia, is reported to have decided to construct a reservoir at Quarryville, to have a capacity of 1,000,000 gal.

**Shippensburg, Pa.*—W. I. Angle, Clk. to Council, writes that the contract for making water-tight the newly constructed concrete reservoir (bids opened Apr. 1) has been awarded to the Vulcanite Paving Co., 2028 Land Title Bldg., Philadelphia, for $13,000.

McSherrystown, Pa.—D. Gring, Newport, Pa., J. B. Landes, Mechanicsburg, and Dr. E. L. Leffler, Millersburg, are reported to have purchased the plants Consumers Water Co., at Hanover, and the McSherrystown Water Co., and will probably expend about $100,000 in improvements.

McKeesport, Pa.—At the annual meeting of the Water Comrs. Apr. 28 the Board recommended that Council provide for a filtration plant.

Bishopville, S. C.—The citizens are reported to have voted Apr. 26 to issue bonds for the construction of water works.

Sumter, S. C.—The citizens are reported to have voted Apr. 26 to issue $116,000 bonds for the purchase of the water works, from the American Pipe Mfg. Co., of Philadelphia, Pa.

Columbia, S. C.—The City Council has authorized the Ways and Means Com. to secure $5,500 for extension of the water mains

Wessington Springs, S. D.—The question of construction of municipal water works is reported under consideration here.

**Belle Fourche, S. D.*—Raymond F. Walter, of Denver, Engr. U. S. Geological Survey, writes that contracts for constructing dam and regulator canal, etc., for diverting flow of Belle Fourche River (bids opened Apr. 10) have been awarded as follows: Schedule No. 1, to S. R. H. Robinson, of St. Louis, Mo., for $99,937, and Schedule No. 2, to Widell-Finley Co., of Chicago, Ill., for $107,260. The cement contract was awarded to the Western Portland Cement Co., of Yankton, S. D. For detail bids received on Schedules Nos. 1 and 2, see issue of The Engineering Record Apr. 22.

Jacksonville, Tex.—The citizens are reported to have voted Apr. 26 to issue $30,000 bonds for the construction of water works

Marshall, Tex.—H. S. Rice, City Secy., writes that bids will be received May 16 for water works improvements, to cost $30,000. Engineer, J. W. Maxcy, of Houston.

**Salt Lake City, Utah.*—Geo. W. Riter, City Engr., writes that the following are the bids opened on Apr. 10 for the construction of water mains: P. P. Ford, $19,319; Midgley Bros., $20,198; W. W. Cook & Son, $20,703; Doyle Bros. & Schwartz, $20,824, and P. J. Moran, $19,498. P. P. Ford, the successful bidder, bid for 5,000 cu. yds. excav. and back fill, 41 cts., and for furnishing and laying c. i. pipe as follows: 12,000 lin. ft. 6 in. 86 cts.; 800 ft. 8 in., $1.30; 800 lin. 10-in., $1.70.

Warrenton, Va.—Contracts will probably soon be let for immediate reservoir work, and perhaps the addition of more water, from plans and specifications now being prepared by Howard Murphy, of Warrenton.

Island Pond, Vt.—The town is reported to have purchased the plant of the Island Pond Water Co. and will construct a reservoir of 500,000 gal. capacity, pipe the streets and supplement the present source of water supply from another stream which has been purchased.

Northfield, Vt.—The citizens are reported to have voted to purchase the springs and water rights of the Andrews Aqueduct Co., and will probably make improvements to the system.

Hardwick, Vt.—John L. Collins, 444 B'way, Albany, is Consulting Engr. for the proposed water works for Hardwick. Estimates not yet completed. A. B. Thomas, Chmn. Special Com.; Chas. French, Village Pres.

Winooski, Vt.—Henry Conlin, Village Clk., writes that it is proposed to bore an artesian well at the water works, at a probable cost of $3,500.

Fairmont, W. Va.—Water bonds to the amount of $180,000 are reported to have been sold on Apr. 25.

Marlinton, W. Va.—See "Power Plants, Gas and Electricity."

Green Bay, Wis.—Prof. D. W. Mead, of Madison, is reported to be preparing plans for the reconstruction of the plant of the Green Bay Water Co.

Casper, Wyo.—Bids will be received by the Superv. Engr., U. S. Reclamation Service, Chamber of Commerce Bldg., Denver, Colo., on June 15 for the construction of the Pathfinder dam and auxiliary works, about 50 miles southwest of Casper, to impound flow of North Platte River, as advertised in The Engineering Record.

**St. John, N. B.*—The Water and Sewerage Bd. is reported to have awarded to McArthur & McVey Sections Nos. 1 and 2 of the water extension at $89,649, and B. Mooney & Sons, of St. John, for Sections Nos. 3 and 4 for $94,024 (bids opened Apr. 12).

**Toronto, Ont.*—Thos. McQueen, Secy. Bd. Control, writes that the contract for furnishing a 6,000,000-gal. triple-expansion wheel pumping engine (bids opened Apr. 18) has been awarded to the John McDougall Caledonian Iron Wks., of Montreal, Que., for $43,947.

Bids will be received by Thos. Urquhart, Mayor, Chmn. Bd. of Control, on June 6 for the construction of a tunnel and shafts under Toronto Bay, as advertised in The Engineering Record.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The lowest bid opened on Apr. 17 by the City Council for the construction of an extension to the central intercepting sewer is stated to have been submitted by Andrew Holloway for $10,980.

Wilmington, Del.—Bids will be received until May 9 by the Bd. Directors of the Street & Sewer Dept. (Leslie V. Cristy, Secy.) for furnishing curb stone, crossing stone, gutter stone, blue-stone gutters, center stones, cement, terracotta pipe, castings, sewer bricks, paving bricks, bar sand, kaolin sand, paving sand and gravel, for a period of 1 year from June 1.

**Salt Lake City, Utah.*—Geo. W. Riter, City Engr., writes that the following are the bids opened on Apr. 10 for the construction of pipe sewers: (*a*) P. J. Moran, (*b*) Palmer & Tate Co., (*c*) W. W. Cook & Son, (*d*) Doyle Bros. & Schwartz, (*c*) P. P. Ford (awarded contract):

	a	*b*	*c*	*d*	*e*
48,000 cu. yds. dry work	$.60	$.60	$.72	$.54	$.51
2,000 cu. yds. wet work	1.15	1.25	1.25	1.10	.90
Furnish and lay pipe sewers:					
60,000 lin. ft. 8-in	.40	.42	.40	.37	.305
800 lin. ft. 10-in	.50	.53	.53	.51	.47
800 lin. ft. 12-in	.65	.63	.60	.63	.59
800 lin. ft. 15-in	.90	.97	.98	1.15	.94
4,500 lin. ft. 18-in	1.32	1.38	1.30	1.53	1.37
150 manholes, 3x4 ft.	57.00	63.00	48.00	49.00	53.75
10 manholes, 4x5 ft.	65.00	73.00	53.00	54.00	59.00
3 flush tanks	75.00	100.00	70.00	77.00	75.00
3 manholes and flush tanks	125.00	160.00	100.00	140.00	135.00
Total	$72,480	$75,374	$76,838	$67,578	$64,627

**Washington, D. C.*—John A. Meade & Co. are reported to have secured the contract for furnishing the coal and ash-handling machinery for the sewage disposal system (bids opened Feb. 6).

Washington, D. C.—See "Miscellaneous."

Augusta, Ga.—Bids will be received May 15 by the Mayor and General Council, for constructing approximately 4,000 ft. trunk sewer in Grant Park. R. M. Clayton, City Engr.

Hopkinsville, Ky.—The City Council is reported to have granted R. C. Hardwick, of Hopkinsville, and associates a franchise for a sewerage system.

Baltimore, Md.—The citizens voted May 2 to issue $10,000,000 bonds for sewers, $1,000,000 for parks and $2,000,000 for the improvement of the Annex by acquiring private streets, paving and curbing and opening new streets.

Brockton, Mass.—The City Council is reported to have under consideration the construction of storm sewer in certain districts.

Everett, Mass.—The Bd. of Pub. Wks. is about to let contracts for sidewalk and sewer brick, also for sewer pipe for the year 1905. Chris. Harrison, City Engr.

Grand Rapids, Mich.—The City Engr. is reported to have prepared plans for a sewer to the Soldiers' Home, to cost $10,000.

St. Paul, Minn.—City Engr. Rundlett is reported to have submitted to the Bd. of Pub. Wks. a revised estimate on the cost of a main sewer, to extend from Bayard and Eustis Sts., so as to serve a small part of St. Anthony Park Dist.; he places at cost at $159,145.

North Platte, Neb.—Bids will be received until May 25 by the Mayor and City Council for constructing the main sewers. Approximate estimate of cost is $30,000. Andrew Rosewater, Engr., Omaha.

Newton, N. J.—The citizens are reported to have voted Apr. 25 to adopt a bill recently passed by State Legislature to issue $100,000 bonds for the construction of a sewerage system, also to merge the sewerage system with the public water works.

Paterson, N. J.—Governor Stokes has reappointed the members of the Passaic River Flood Commission, and they will proceed to make plans for the works needed to prevent floods in that stream. Meanwhile appraisers will be appointed to estimate the benefits which the construction of these works will bring to property along the river. If these benefits exceed the commission's estimate of the cost of the works, the latter will be built at once.

Brooklyn, N. Y.—Bids will be received May 11 by Martin W. Littleton, Pres. Boro. Brooklyn, for furnishing materials and constructing sewers in portions of New York Ave., Glenwood Road, E. 23d and 60th Sts. Engineer's estimate, 1,930 lin. ft. 12 in. and 90 lin. ft. 15 in. pipe sewer; 144 cu. yds. concrete cradle; 20 manholes; 10 sewer basins, etc.

Syracuse, N. Y.—The following are reported to be the bids opened on May 1 by the Bd. of Contract and Supply for sewers in Herriman and other streets: Troy Public Wks. Co., $23,701; Sam. Bonn, $17,721; John Dovin, $17,703; Thos. Marnell, $25,345; Jas. Swift, $17,730; C. T. Hookway, $18,886 and Young & Woods, $23,430.

St. Johnsville, N. Y.—The City Clk. writes that the citizens voted Apr. 29 to appropriate $500 to be expended for a survey and estimate of cost for construction of a sewerage system.

Binghamton, N. Y.—It is proposed to construct brick sewers in the 5th Ward, at a cost of $13,500. S. M. Baird, City Engr.

Ballston Spa, N. Y.—The Assembly is reported to have passed the bill providing for the disposal of the sewage of this village; probable cost of the work is $150,000.

Amsterdam, N. Y.—It is stated that bids will be received May 17 for 2,300 ft. of 8 and 10-in. pipe sewer extension. F. E. Crane, City Engr.

Rochester, N. Y.—City Engr. Fisher is reported to be preparing plans for a sewer in East Ave.

**Ellendale, N. D.*—T. E. Haskins, City Aud., writes that the contract for constructing a sewer in Railroad Ave. (bid opened Apr. 24) has been awarded to Symms, Powers Co., of Sioux Falls, S. D., for $16,552.

Findlay, O.—Bids will be received May 9 by the Bd. Pub. Service (J. C. Edie, Clk.) for furnishing a sewer in a portion of Tiffin Ave.

Cincinnati, O.—Bids will be received by the Bd. of Pub. Service (Geo. F. Holmes, Clk.), until May 12, for furnishing materials and constructing sewers and drains in portions of Pine St.

Bids will be received May 29 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and constructing sewers and drains in portions of Quebec, Jonte, Glenway, Austerlitz Aves. and Bassett Road.

Steubenville, O.—Bids will be received by the Bd. of Pub. Service, May 19, for the construction of either brick or pipe sewers, or both, as advertised in The Engineering Record.

Columbus, O.—Bids will be received May 18 by the Bd. Pub. Service (Chas. H. Frank, Secy.) for furnishing material and repairing the Indianola sewer and constructing embankments. Approximate estimates: 11,000 cu. yds. earth embankment; 162,000 new brick furnished; 405,000 brick laid, including cleaning of old brick, and 1,000 lin. ft. wire, for reconstructing fence; Julius Griggs, Ch. Engr., Bd. Pub. Service.

Columbus, O.—See "Power Plants, Gas and Electricity."

Zanesville, O.—Local press reports state that the construction of sewers is in contemplation in E. Market St., Muskingum Ave. and in the 7th ward.

Sharon Hill, Pa.—Bids will be received until May 16 by the Sewer Com. for constructing a system of sewers, as advertised in The Engineering Record.

Freeport, Pa.—Bids will be received by the Burgess and Boro. Council until May 15 for sewering, grading, curbing and paving High, Buffalo, Franklin and 3d Sts., as advertised in The Engineering Record.

Marion, S. C.—Bids will be received May 20 by the Sewerage Comn. (W. J. Montgomery, Chmn.), for constructing a complete system of pipe sewers for this city.

Newport News, Va.—T. E. Pease, City Engr., writes that it is proposed to construct a sewerage system in the east end at a probable cost of $8,000. Work will likely be done by the city forces.

Puyallup, Wash.—It is stated that bids are wanted May 19 for constructing a sewerage system. Dunn, Coale & Dunn, Engrs., Seattle.

McMechen, W. Va.—The question of constructing a sewerage system here is reported under consideration.

Green Bay, Wis.—It is stated that bids will be received by the Com. on Sewers & Plumbing of the Common Council until May 16 for constructing several vitrified pipe sewers.

Havana, Cuba.—The Cuban House of Representatives is reported to have passed the Senate bill appropriating $1,500,000 to assist the municipalities in the work of sanitation.

BRIDGES.

Notes Arranged Alphabetically by States.

Tahoe, Cal.—See "Water."

Weaverville, Cal.—R. Carter, Co. Clk., writes that it is proposed to construct a bridge over Trinity River near Lowdens Ranch. Contracts will probably be let in July.

**Lyme, Conn.*—C. M. Ingersoll, Ch. Engr., N. Y., N. H. & H. R. R. Co., New Haven, writes that Daly & Holbrook, of Mt. Kisco, N. Y., has secured the contract for the substructure of a bridge over Connecticut River at Lyme.

Washington, D. C.—The following bids are stated to have been received May 1 for the construction of a 7-span steel bridge across the Eastern branch of Potomac River at 11th St. S.; *a* for superstructure, *b* for portion of bridge which supports the tracks of railroad company, *c* for bridge complete, *d* for substructure: Penn Bridge Co., of Beaver Falls, Pa., *c* $319,160, *b* $20,300; King Bridge Co., Cleveland, O., *a* $169,900, *b* $21,000; McClintick-Marshall Constr. Co., of Pittsburg, Pa., *a* $160,000, *b* $18,050; Pennsylvania Steel Co., of Steelton, Pa., *c* $353,000, *b* $25,000, *d* $180,000, *a* $173,000, or $348,000, including the light draw according to their own plans; Geo. W. Capp Constr. Co., of New York, N. Y., *c* $342,000, *b* $21,000; McMullen & McDermott, of Washington, D. C., *c* $338,206, *b* $18,250, *d* $178,700, and *a* $159,500.

**Indianapolis, Ind.*—Fritz & Frazier are stated to have received the contract for constructing a bridge over Buck Creek in Center Township for $6,207 (bids opened Apr. 25).

Rockville, Ind.—Harry Grube, Aud. Park County, is reported to be receiving bids for the construction of a bridge over Sugar Creek in Reserve Township.

St. Peter, Minn.—It is reported that bids will be received until May 9 by the Bd. Co. Superv., for constructing 4 stone bridges in Belgrade Township.

Park Rapids, Minn.—It is reported that the Co. Bd. Comrs. will receive bids until May 15 for constructing a 56-ft. steel bridge.

Huntley, Mont.—See "Water."

Rome, N. Y.—The House is stated to have passed a bill providing for an appropriation of $20,000 to construct a bridge over the canal at S. Washington St.

New Rockford, N. D.—Bids will be received May 22 by the Co. Comrs. for furnishing material and constructing 3 steel bridges in this Co.; W. C. Schwoebel, Co. Aud.

Cincinnati, O.—The City Engr. is stated to have estimated the cost of improving the Liberty St. Viaduct at $6,000.

Dayton, O.—Bridge bonds amounting to $37,000 are reported sold.

Cleveland, O.—Bids will be received May 16 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing material and constructing a concrete steel arch bridge in Edgewater Park.

Bowling Green, O.—It is reported that bids are wanted until May 22 for $40,000 Co. bridge bonds; B. C. Harding, Co. Aud.

**Items marked thus give the names of parties awarded contracts.*

Chicago, Ill.—The following are the bids recently opened by the Bd. of Pub. Wks. for the superstructure of North Ave. Bridge: (*a*) Roemheld & Gallery, 719 Chamber of Commerce Bldg.; (*b*) American Bridge Co.; (*c*) John P. Agnew; (*d*) C. L. Strobel; (*e*) Standard Constr. Co.; (*f*) Jackson & Corbett; (*g*) King Bridge Co.; (*h*) Morava Constr. Co.; (*i*) Chicago Bridge & Iron Wks.; (*j*) J. J. O'Heron.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
Superstructure complete	$111,983	$112,113	$113,168	$117,800	$120,980	$123,421	$131,000	$132,500	$136,000	$152,000
Erected in place, per lb. (extra).										
Medium or soft steel	.05¼	.05½	.06	.05½	.05	.06½	.05½	.04½	.06	.06
Iron castings	.04½	.04½	.04	.05	.05	.05½	.07	.03	.06	.05
Cast steel for superstructure	.10	.11	.12	.12	.09	.15	.07¼	.10	.10	.06
Steel castings for machinery	.14	.14	.12	.13	.16	.15	.07¼	.20	.15	.15
Phosphor bronze	.55	.50	.60	.60	.50	.55	.45	.50	.50	.60
Pig iron for counter weight	.01¼	.01½	.02½	.01½	.01½	.03½	.01¼	.02	.01¼	.04
Counter weight block or plate castings	.02½	.02	.04	.02½	.02	.05	.01 7-10	.02	.02½	.05

**Paris, Ill.*—W. T. Blackburn, City Engr., writes that the following are the bids opened on Apr. 14 for paving Madison St. with brick: (*a*) Robert Naeger, Greensburg, Ind.; (*b*) Chas. D. Fry & Co., Greenfield, Ind.; (*c*) Wolf, Maupin & Curdy, Alton; (*d*) J. N. Stuart, Paris; (*e*) Morrisey & Porter, Paris (awarded contract); (*f*) R. H. Baum, Paris; (*g*) Roberts & Co., Terre Haute, Ind.; (*h*) P. H. Hunt & Co., Decatur; (*i*) Sheehan & Frey, Lafayette, Ind.

	a	*b*	*c*	*d*	**e*	*f*	*g*	*h*	*i*
7,307 cu. yds. excav.	$0.25	$0.26	$0.17	$0.25	$0.18	$0.21	$0.25	$0.30	$0.19
496 ft. resetting curb	.10	.07½	.06	.10	.06	.09	.10	.10	.06
7,312 lin. ft. combined curb and gutter	.45	.38	.37	.40	.39	.40	.30	.48	.39
11,148 sq. yds. brick pavt.	1.40	1.32	1.38	1.30	1.27	1.31	1.40	1.43	1.40
11,148 sq. yds. cement fill.	.08	.08	.07½	.10	.09	.08	.08	.10	.07
5 radius inlets	15.00	11.25	12.00	18.00	12.50	15.00	15.00	7.20	10.00
5 straight inlets	15.00	11.00	9.00	18.00	12.50	15.00	15.00	7.20	9.00
845 ft. 10 in. storm drain	.40	.50	.25	.28	.25	.25	.40	.30	.25
465 ft. 8 in. storm drain	.30	.45	.20	.25	.25	.20	.30	.25	.25
10 catch basins	28.00	27.50	20.00	12.00	28.00	22.00	28.00	20.00	25.00
Total	$21,823	$20,561	$20,297	$20,311	$19,550	$20,044	$20,727	$22,550	$20,760

Zanesville, O.—It is reported that bids will be received until May 25 by the Bd. Co. Comrs., for furnishing material and constructing the superstructure of a highway bridge in Salt Creek Township, over Little Salt Creek, to consist of 1 span, 100 ft. in length, and roadway 14 ft.; proposals must be accompanied by plans and specifications. L. E. Brelsford, Co. Aud.

Catasauqua, Pa.—It is stated that the Comrs. of Lehigh County will soon receive bid for constructing an overhead bridge at Front and Pine Sts., to connect with West Catasauqua. The structure to be 1,100 ft. long and cost about $80,000.

West Newton, Pa.—The plans and specification of Emil Swenson, of Pittsburg, for a bridge to cross Youghiogheny River at West Newton, are reported to have been accepted, the structure to cost $65,000.

Mitchell, S. D.—It is stated that bids will be received May 20 by O. D. Stearns, Co. Aud., for constructing a steel bridge, 100-ft. span, across James River in Perry Township.

**Palestine, Tex.*—The Missouri Valley Bridge Co., of Leavenworth, Kan., is stated to have received the contract for replacing all bridges with steel structures on the line of the International & Great Northern R. R., between Palestine and San Antonio. The probable cost of the improvement is $600,000.

Beeville, Tex.—Bids will be received May 10 by the Co. Coms. Court for erecting a steel bridge over Paesta Creek, about 4 miles east of Beeville; Dan Troy, Co. Clk.

Salem, Va.—It is stated bids will be received by R. W. Kime, Co. Comr., until May 13, for erecting an iron bridge over Carven's Creek, on Hollins Road.

Norfolk, Va.—It is stated that plans are being prepared by C. A. P. Turner, the Phœnix, Minneapolis, Minn., for 2 aerial ferry bridges to be constructed over the north and east branches of Elizabeth River for the Norfolk Viaduct Co., of Norfolk. The first to have a 400-ft. span and the second a 500-ft. span. The probable cost of structures is $350,000.

**Tacoma, Wash.*—The contract for constructing a bridge 653 ft. long over an arm of Henderson Bay at Purdy is stated to have been awarded to the Northwest Bridge Co., Bernice Bldg., for $5,280 (bids opened Apr. 21).

Everett, Wash.—It is stated that bids will be received May 15 by the Co. Comrs. for constructing a bridge across south fork of Stillaquamish River, near Granite Falls. S. Vestal, Co. Aud.

**Milwaukee, Wis.*—Frank P. Schumacher, Secy. Park Bd., writes that the contract for constructing a reinforced concrete foot bridge in Lake Park (bids opened Apr. 13) has been awarded to Newton Eng. Co., 35 Hathaway Bldg., for $6,246.

New York, N. Y.—The following are the bids opened on Apr. 20 by Louis F. Haffen, Pres. Bronx Boro., for constructing approaches to bridges over N. Y. Central & Hudson River R. R., and the N. Y. & Putnam R. R., at Depot Pl. and W. 177th St.: (*a*) John J. Hopper, 215 W. 125th St.; (*b*) J. C. Rodgers, 1909 Amsterdam Ave.; (*c*) Century Constr. Co., 5 E. 42d St.; (*d*) John J. Hart Co., 69 Broad St.; (*e*) Snare & Triest Co., 39 Cortlandt St.; (*f*) Gallo & Pettelli, 127 Mulberry St.; (*g*) Cunningham & Kearns, 440 E. 91st St.; (*h*) T. V. Smith, 147 E. 125th St.; (*i*) Driscoll & Cronin, 2337 Bway.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
Removal and disposal of old bulkheads, piles, etc.	$1500.00	$1000.00	$1250.00	$1500.00	$700.00	$500.00	$2000.00	$1000.00	$1500.00
6,300 cu. yds. excav.	1.50	.50	1.51	2.25	2.00	2.00	2.00	1.50	1.10
31,200 lin. ft. bearing piles	.35	.30	.39	.30	.30	.26	.18	.35	.21
29,200 cu. yds. fill. and back fill	.35	.40	.75	.70	.30	.08	.38	.35	.30
800 cu. yds. rock fill	1.00	1.00	1.50	1.25	.90	.50	1.00	2.25	1.25
2 standard receiving basins	200.00	150.00	218.75	200.00	100.00	150.00	150.00	159.00	150.00
3 inlets	75.00	100.00	112.50	75.00	40.00	60.00	150.00	60.00	50.00
130 lin. ft. vitr. stoneware pipe, 12 in. diameter	1.20	2.00	.75	3.00	2.00	1.00	1.50	2.50	1.00
50 lin. ft. vitr. stoneware pipe, 8 in. diameter	1.00	1.50	.44	2.50	1.30	1.00	1.25	1.00	.90
1,950 cu. yds. dry rubble masonry	2.50	3.00	3.13	2.50	5.00	1.00	2.00	2.75	3.30
290 cu. yds. Class "A" concrete	10.00	10.00	9.00	14.00	8.00	7.00	7.30	9.00	9.50
9,100 cu. yds. Class "B" concrete	7.50	6.00	6.63	7.50	6.70	3.50	6.00	6.00	5.75
10 cu. yds. Class "C" concrete	25.00	20.00	16.25	20.00	20.00	15.00	30.00	40.00	21.00
100 additional bbls. Portld. cement	1.75	3.00	1.56	1.50	1.50	1.50	1.75	1.50	1.50
110 sq. yds. waterproofing	.80	1.00	.50	1.25	1.00	1.00	.72	.70	.30
25 M. ft. lumber	45.00	40.00	43.75	40.00	40.00	20.00	60.00	40.00	40.00
3,400 lin. ft. new curb	1.00	.90	.94	.85	.40	.80	.85	.80	.80
16,400 sq. ft. new flag	.35	.25	.31	.28	.20	.27	.24	.24	.24
900 sq. ft. new bridgestone	.75	.60	.81	.65	.30	.80	.50	.60	.68
3,500 sq. yds. granite block	2.75	2.50	2.81	2.50	2.00	2.25	2.00	2.40	2.45
300 sq. yds. asphalt block	2.50	2.00	2.24	2.50	2.00	2.50	1.75	2.50	3.00
4,000 sq. yds. macadam	1.50	1.50	.75	1.25	1.00	1.35	1.25	1.20	1.00
155,000 lbs. iron and steel	.05	.04	.043	.045	.03	.04½	.04½	.04½	.05
11,500 lbs. reinforcing bars	.05	.03	.04	.035	.03	.03	.03½	.05	.04
2,000 sq. ft. woven wire fabric	.04	.10	.08	.10	.04	.05	.05	.10	.06
1,850 lin. ft. ornamental railing	3.25	2.00	2.80	4.00	2.00	4.00	3.50	3.00	2.50
400 lin. ft. gas pipe railing	1.25	1.00	1.96	2.25	1.00	2.00	2.00	2.00	1.25
Total	$152,556	$125.880	$126,378	$164,770	$133,000	$99,115	$130,448	$133,833	$119,138

Chicago, Ill.—The following are the bids recently opened by the Bd. Pub. Wks. for the substructure of the North Ave. Bridge: (*a*) Jackson & Corbett, 1132 Rookery Bldg.; (*b*) Chicago & Great Lakes Dredge & Dock Co.; (*c*) Fitzsimons & Connell:

	a	*b*	*c*
Removing old bridge	$3,000.00	$2,000.00	$2,500.00
Building and removing cofferdams	16,000.00	14,500.00	15,000.00
Miscellaneous work	800.00	800.00	750.00
3,000 cu. yds. excav.	$0.90	$0.75	$0.75
10,000 cu. yds. dredging	.25	.25	.25
40 M. ft. oak timber	40.00	50.00	55.00
4 M. ft. pine timber	40.00	40.00	45.00
40 M. ft. pine lumber	32.00	30.00	35.00
50,000 lin. ft. piles delivered	.18½	.19	.18
37,000 lin. ft. piles driven	.08½	.12	.11
3,800 cu. yds. Portland cement concrete piers	5.45	5.85	6.00
875 cu. yds. Portland cement concrete curb walls	5.45	6.25	6.00
155 cu. yds. Portland cement mortar	16.00	16.00	15.00
37 cu. yds. Bedford coping stone	14.00	20.00	18.00
14.5 cu. yds. granite coping stone	60.00	70.00	80.00
1,070 cu. yds. rubble masonry	4.15	4.00	4.50
2,000 cu. yds. filling in approaches	.25	.25	.35
1,000 sq. yds. cedar block pavt.	1.30	1.50	1.60
62,000 lbs. structural steel	.04	.03¾	.03¾
4,500 lbs. iron castings	.04¾	.03¾	.03½
1,000 lbs. steel castings	.07	.04	.08
58,000 lbs. corrugated steel bars	.03¼	.03¾	.03¾
50 lin. ft. diverting 4½ ft. sewer	6.75	6.50	6.00
40 lin. ft. diverting 6½ ft. sewer	9.00	9.50	10.00
Total	$81,368	$83,377	$84,903

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Denver, Colo.—The following bids are stated to have been opened on Apr. 21 by the Bd. of Pub. Wks. for grading, curbing and surfacing the west side improvement dist. No. 1, quantities required 213,700 sq. yds. disintegrated granite surfacing, 53,700 cu. yds. grading, 34,100 ft. lumber, 94,420 lin. ft. sandstone curbing, 2,970 lin. ft. of circular granite, and 2,975 lin. ft. sandstone curbing: Dillon Stone Co., $169,534; Colorado Co., $162,029; R. A. Young, $172,235; J. Fred Roberts, $156,467, and Denver & Pueblo Constr. Co., $157,636.

Wilmington, Del.—See "Sewerage and Sewage Disposal."

Washington, D. C.—See "Miscellaneous."

Washington, D. C.—Bids will be received by the Comrs. D. C. May 20 for grading and regulating suburban streets and avenues, as advertised in The Engineering Record.

Lewiston, Idaho.—It is stated that bids will be received until May 10 by J. R. Lydon Co. Clk. for constructing a part of L. E. Marchand Road.

Bloomington, Ill.—It is proposed to pave portions of Olive and West Sts. with brick. Elmer Folsom, City Engr.

Kankakee, Ill.—Property owners have petitioned the Bd. of Local Improv. to pave the alleys of 6 blocks with brick, amounting to about 8,000 sq. yds.

Ft. Sheridan, Ill.—Capt. Wm. Weigel, Constr. Q. M., U. S. A., writes that only one bid was received and opened on Apr. 10 for furnishing and laying about 20,000 sq. ft. of vitrified brick paving and the same was rejected as being excessive. The work will be performed by the purchase of the brick and the laying of the same without further advertising.

Chicago, Ill.—The West Park Comrs. are stated to have adopted plans and estimates for improving Sacramento Ave. Estimated cost of improvement is $145,821.

Bids will be received May 9 by the Bd. Local Improv. (And. M. Lynch, Pres.) for improving portions of 21 streets, by grading, curbing and paving with vitrified blocks, granite blocks and limestone.

East St. Louis, Ill.—The following are the bids opened on Apr. 29, improving 2d St. from St. Clair Ave. to Lynch Ave., including 9,746 sq. yds. brick paving. The totals are for all work, except paving, paving price given per sq. yd.: Wm. F. Stillwell, Lafayette, Ind., $8,503 and $1.65, $1.66 and $1.68 per sq. yd. for paving, according to material used; Geisel Constr. Co., St. Louis, Mo., $11,850 and $1.29, $1.32, $1.33 and $1.34 for paving; Hill-Gaynard Constr. Co., East St. Louis, $11,294 and $1.36, $1.37 and $1.40 for paving; M. J. Keeley, East St. Louis, $10,774 and $1.39 and $1.40 for paving; McCabe & Co., East St. Louis, $10,320 and $1.47½, $1.49½, $1.51 and $1.52 for paving, and Wolf, Maupin & Curdin, Alton, $11,116 and $1.57, $1.58, $1.60 and $1.63 for paving.

**Bluffton, Ind.*—Thos. C. Guldin, Deputy County Surveyor, writes that the following are the successful bidders for the construction of 15 gravel roads (bids opened Apr. 20): Elijah Huffman & Co., Mt. Zion, Ind., for Roads Nos. 3, 4, 5, 8, 11, 12, 13 and 15 for a total of $41,300 and to Jas. Crosbie & Co., Bluffton, for Roads Nos. 6, 7, 9, 10 and 14, for a total of $17,414.

Terre Haute, Ind.—Bids are wanted until May 17 for improving Wabash Ave., from 13th to 19th Sts., by paving with vitrified brick and curbing with oolitic limestone; estimated sq. yds., 15,500. N. S. Kidder, City Engr.

**South Bend, Ind.*—Contracts for brick paving (bids opened Apr. 25) have been awarded as follows (Contractors all of South Bend): To C. H. Defrees, for paving Portage Ave., 16,564 sq. yds. with Nelsonville block, cement filler, $22,458; H. N. Barnes, for 16,049 sq. yds. with Poston block cement filler on La Salle Ave., $22,142; Sidere Co., for 5,868 sq. yds., with Hadley block, sand filler, on Arnold St., for $8,303, and Jas. Nelson for 17,510 sq. yds. Nelsonville block, sand filler, on Vistula Ave., for $23,481.

**Davenport, Ia.*—The Davenport Construction Co., of Davenport, is reported to have secured the contract for paving portions of 9 streets, requiring about 16,076 sq. yds. of vitrified brick on a 5-in. Portland cement concrete foundation (bids opened April 18), the company bidding $1.45, $1.47, $1.52 and $1.53 per sq. ft. on the various streets.

Louisville, Ky.—The Bd. of Pub. Wks. is stated to have passed the ordinances providing for the paving with vitrified brick on a portion of Slevin St., also for constructing sidewalks on 7th, 11th, Walnut, Grayson and 9th Sts.

New Orleans, La.—The Streets and Landings Com. of Council is stated to have reported favorably on the paving of a portion of Opelousas Ave.

**Items marked thus give the names of parties awarded contracts.*

The specifications of the City Engr. for a municipal asphalt repair plant are stated to have been adopted by the Com. on Finance and Streets and Landings.

The following bids are stated to have been opened Apr. 24 by the Finance Com. of Council for paving with asphalt portions of *a* Iberville St., *b* Conti St., *c* Dauphine St. and *d* Burgundy St., price given per sq yd.: Louisiana Improv. Co., *a* $2.38 2/3, *b* $2.25, *c* $2.38, *d* $2.25; Barber Asphalt Paving Co., *a* $2.02 1/6, *c* $2.06 2/3, *d* $1.97 1/2; Sicilian Asphalt Paving Co., *a* $2.39 1/6, *b* $2.30 5/6.

Salisbury, Md.—About 5,000 to 9,000 sq. yds. brick pavement will probably be constructed this year.

Baltimore, Md.—Mayor Timanus has signed ordinances providing for the paving of portions of Patuxent and Mosher Sts.

Baltimore, Md.—See "Sewerage and Sewage Disposal."

Upper Marlboro, Md.—Bids will be received May 16 by the Co. Road Comrs., for grading and macadamizing of about 2 miles of the Marlboro Turnpike; E. R. Boyle, Supt. Roads.

Everett, Mass.—See "Sewerage and Sewage Disposal."

**Minneapolis, Minn.*—The following bids are stated to have been opened on Apr. 14 for furnishing 40,000 sq. yds. of creosote blocks: Terre Haute Paving Co., $1.64; Republic Creosoting Co., 4 bids, ranging from $1.58 to

**Duluth, Minn.*—The Bd. of Pub. Wks. is stated to have opened on Apr. 21 the following bids for paving a portion of 1st St.: *a* with asphalt, *b* sandstone block, *c* creosote block, *d* bitumen: Barber Asphalt Co., *a* $36,593; Geo. C. Warren, *a* $38,255; P. McDonnell, 124 W. Superior St., *a* $40,315, *d* $29,319, *b* $38,396, *c* (2 bids), $38,660 and $42,656 (awarded contract); Fred A. Mallatte, *d* $32,427; Geo. R. King, *d* $35,554, *b* $41,828, *c* (2 bids), $41,948 and $46,743; Sang & Preston, *b* $43,458, *c* (2 bids), $46,814 and $51,929.

Nashua, N. H.—This city will probably lay about 4,000 sq. yds. block paving on a concrete base with cement grouted joints. E. J. Johnson, City Engr.

**Newark, N. J.*—Wm. C. Shanley is stated to have received the contract for paving portions of the following streets with granite block as follows: West side of New Jersey Railroad Ave., $32,697; Ferry St., $31,632; Parkhurst St., $4,015; Mulberry St., $15,432; E. Kinney St., $15,352; 16th Ave., $30,962, or a total of $130,090.

Trenton, N. J.—Bids will be received May 16 by the Common Council, for paving a portion of Monmouth St. with sheet asphaltum on a concrete base. Harry B. Salter, City Clk.

New York, N. Y.—The following are the bids opened on Apr. 20 by Louis F. Haffen, Pres. Bronx Boro., for regulating, etc.: Tiebout Ave. from E. 180th St. to Fordham Road, G. I. Bailey, $32,846; Hannan Const. Co., $34,180; Clinton Beckwith, $38,597; D. W. Moran, $38,620; J. C. Voorhies, $35,110; M. O'Connell, $35,661; M. J. Leahy, $33,546; T. Grogan, $32,821; Bellew & Merrit Co., $33,171; Madigan & Warner, $37,289. The detail bid of T. Grogan, the lowest bidder, is as follows: 8,550 cu. yds. earth excav., $1; 7,300 cu. yds. rock excav., $1; 16,150 cu. yds., fill, 10 cts.; 7,125 lin. ft. new curb., $1; 28,275 sq. ft. new flag., 20 cts.; 1,875 sq. ft. new bridgestone, $1; 700 cu. yds. dry rubble masonry, $1.

Townsend Ave. from E. 170th St. to E. 176th St.: Uvalde Asphalt Paving Co., $36,332; D. W. Moran, $38,732; P. J. Duffy, $43,467; Gallo & Pettelli, $40,127; G. I. Bailey, $40,013; T. F. Murray, $44,277. The detail bid of the Uvalde Asphalt Paving Co., the lowest bidder, is as follows: 2,250 cu. yds. rock excav., $1.49; 49,000 cu. yds. fill, 37 cts.; 6,800 lin. ft. new curb., 79 cts.; 26,350 sq. ft. new flag., 28 cts.; 2,550 sq. ft. new bridgestone, 45 cts.; 600 cu. yds. dry rubble masonry, $1.50; 7,200 cu. yds. earth excav., 1 ct.

149th St. from Southern Boule. to East River: P. J. Kane, $66,370; P. J. Duffy, $36,787; A. G. Vermilye, $46,450; Cunningham & Kearns, $28,640; T. Crimmins Cont. Co., $43,260; Norton & Dalton Cont. Co., $41,850; C. W. Collins, $32,250, and F. V. Smith Cont. Co., $20,310.

Bids will be received until May 11 by the Park Bd., N. Y. City (John J. Pallas, Pres.) for paving with rock asphalt mastic portions of the present cobblestone and stone block gutters of the carriage drives in Central Park.

Bids will be received by John F. Ahearn, Boro. Pres., until May 10, for regulating and repaving portions of 21 sts.; engineer's estimate: 43,390 sq. yds. asphalt pavt., including binder course; 41,310 sq. yds. old stone pavt., relaid as foundation or in approaches, etc.; 21,610 lin. ft. new bluestone curb, furnished and set; 2,895 lin. ft. old bluestone curb, redressed, rejointed and reset; 115 noiseless covers, complete, for sewer manholes, furnished and set; 41 noiseless covers, complete, for water manholes, furnished and set, etc.; also for regulating, grading, curbing, flagging, etc., portions of W. 167th and W. 140th Sts., and flagging and reflagging the sidewalks of portions of Delancey St. and B'way. Engineer's estimate: 87,290 sq. ft. new flagstone, furnished and laid; 26,730 sq. ft. old flagstone, to return and relay; 1,425 lin. ft. new curb, furnished and set, etc.; all in Boro. Manhattan.

Findlay, O.—The City Council is stated to have passed an ordinance providing for the issue of $19,000 bonds for paving with vitrified block on a portion of Carnahan Ave.

**Brooklyn, N. Y.*—The following are the bids opened on Apr. 26 by Martin W. Littleton, Pres. Brooklyn Boro., for paving with granite on a concrete foundation: (*a*) 20th St. from 3d to 7th Aves., (*b*) Willoughby Ave. from Central to Knickerbocker Aves., (*c*) Furman St. from Atlantic Ave. to Fulton St., (*d*) Lexington Ave. with granite block and asphalt from Grand to Throop Aves. (Bidders of Brooklyn, unless otherwise mentioned.): Hickey-McFarlane Co., 2d Ave. and 6th St., *a* $34,841; B. Alcatraz Co., 12th and Gowanus Canal, *a* $34,733 (awarded contract), *d* $47,777 (awarded contract); George & Farrell, 576 Douglass St., *a* $34,948, *b* $15,395, *c* $34,291; Chapman & Ryan, 156 3d St., *a* $36,129, *c* $36,946; Norton & Gorman, 303 Douglass St., *a* $36,207, *b* $18,019, *c* $35,653; Jas. Quinn, Sr., 1481 Ave. A, New York, *a* $36,422, *b* $15,574, *c* $34,040 (awarded contract), *c* $34,406; O'Grady Bros., 72 N. 8th St., *b* $15,618; Newman Constr. Co., 1127 Willoughby St., *b* $15,222; Barber Asphalt Paving Co., 114 Liberty St., N. Y. City, *d* $58,565; Uvalde Paving Co., 1 Bway., N. Y. City, *d* $49,748; Cranford Co., 52 9th St., *d* $54,229.

*The detailed bids for the successful bidders on the above work are as follows: 20th St. to Brooklyn Alcatraz Co.: 9,500 sq. yds. granite block pavt., with tar and gravel joints, $2.40; 1,870 cu. yds. concrete, $4; 5,150 lin. ft. new curb., 80 cts.; 570 lin. ft. old curb. reset, 30 cts.; 260 sq. ft. new granite bridgestones, 60 cts. Willoughby Ave., Cunningham & Kearns: 4,120 sq. yds. granite pavt., with tar and gravel joints, $2.43; 810 cu. yds. concrete, $3.90; 2,400 lin. ft. new curb., 74 cts.; 80 lin. ft. old bluestone curb. reset, 24 cts.; 190 sq. ft. new granite bridgestone, 64 cts. Furman St., Jas. Quinn, Sr.: 7,270 sq. yds. granite block pavt., with tar and gravel joints, $2.37; 1,800 sq. yds. old granite pavt. relaid, with tar and gravel joints, $1.06; 30 sq. yds. adjacent pavt., 25 cts.; 1,940 cu. yds. concrete, $4.10; 8,120 lin. ft. new curb., 81 cts.; 200 lin. ft. old bluestone curb. reset, 40 cts.; 330 sq. ft. new granite bridgestone, 70 cts.; 350 sq. ft. old bridgestone relaid, 15 cts. Lexington Ave., Brooklyn Alcatraz Co., 14,330 sq. yds. asphalt pavt., 75 cts.; 5,820 sq. yds. granite block pavt., with tar and gravel joints, $2.40; 20 sq. yds. adjacent pavt., 30 cts.; 3,490 cu. yds. concrete, $4.25; 9,960 lin. ft. new curb., 80 cts.; 750 lin. ft. old bluestone curb. reset, 30 cts.

The following are the bids opened Apr. 26 by Martin W. Littleton, Pres. Brooklyn Boro., for paving with asphalt on a concrete foundation: (*a*) Hart St. from Marcy Ave. to Bway., (*b*) Evergreen Ave. from Willoughby to Green Aves., (*c*) Hamburg Ave. from Flushing to Myrtle Aves.: Brooklyn Alcatraz Co., Brooklyn, *a* $31,816; Uvalde Asphalt Paving Co., 1 Bway., N. Y. City, *a* $32,265, *b* $13,857 (awarded contract), *c* $18,036; Cranford Co., 52 9th St., Brooklyn, *a* $31,545 (awarded contract), b $16,075, *c* $23,340; Barber Asphalt Paving Co., 114 Liberty St., N. Y. City, *a* $31,757, *b* $14,136, *c* $20,718; Interstate Paving Co., 44 Court St., Brooklyn, *a* $34,727, *b* $14,850 : The detail bid of the Cranford Co. for paving Hart St. is as follows: 16,900 sq. yds. asphalt, 80 cts.; 2,790 cu. yds. concrete, $3.67; 7,920 lin. ft. new curb., 79 cts.; 930 lin. ft. old curb. reset, 29 cts., and 44 noiseless covers, ea. $14.

*Robertson & Gerehart, 3d Ave. and 77th St., Brooklyn have secured the contract (bids opened Apr. 26) for laying sidewalks on Narrows Ave., at the following bid: 3,720 lin. ft. new curb., $1.12; 20,858 cu. yds. earth excav., 15¾ cts., and 18,270 sq. ft. cement sidewalks, 14 cts.

*Jas. Purcell, 79th St., bet. 3d. and 4th Aves., Brooklyn, has secured the contract for regulating, etc., 58th St., 1st to 4th Ave., at the following bid: 980 sq. yds. brick gutter, set in concrete, $2.30; 4,387 lin. ft. curb. set in concrete, $1.05, and 29,397 cu. yds. earth excav., 39 cts.; total $12,152.

**Long Island City, L. I., N. Y.*—Bids opened by Jos. Cassidy, Pres. Boro. of Queens, on May 1, are reported to have been awarded as follows: Paving with asphalt a portion of Ditmars Ave., Barber Asphalt Paving Co., 6th St. and West Ave., for $8,250; paving with brick or block pavement portions of Greene Ave., Ralph, Harman, Grover and Himrod Sts., to Wm. Booth, of N. Y. City, for $125,384; regulating, grading, curbing, flagging and laying cross-walks on portions of 3d and 16th Aves., also regulating, grading, curbing and laying sidewalks on Crescent, N. Henry, Prospect Sts. and Webster Ave., to Union Constr. Co., of Brooklyn, for $44,855; curbing and paving with virtrified brick or block portion of Gates Ave., also regulating, grading, curbing a portion of St. Nicholas Ave., to John J. Young, of Maspeth, for $27,738; for grading, curbing and laying crosswalks on a portion of 15th Ave., to Queensborough Constr. Co., of Ozone Park, for $10,850.

**New Brighton, S. I., N. Y.*—The following are the bids opened on Apr. 25 by Geo. Cromwell, Pres. Richmond Boro., for furnishing material and repaving with vitr. brick on concrete foundation Richmond Terrace from Ferry St. to Lafayette Ave.: E. A. Matthews, 21 Park Row, N. Y. City, $17,384; Russell Constr. Co., 156 5th Ave., N. Y. City, $15,927 (awarded contract); John E. Donovan, Port Richmond, $16,885; Jos. Johnson's Sons, W. New Brighton, $17,193; John F. Donovan, W. New Brighton, $16,603; Michael Fitzgerald, 312 W. 141st St., N. Y. City, $17,267, and J. K. Summers, 255 E. 71st St., N. Y. City, $16,350. The detail bid of the Russell Constr. Co., the successful bidders, is as follows: 5,100 sq. yds. vitr. brick, $1.98; 670 cu. yds. concrete, $4,55; 2,900 lin. ft. new curb. 20-in, 95 cts., and 30 sq. ft. new flag., 35 cts.

*Bids were opened same time and place for furnishing material and repaving with granite block on sand the gutters of Beach St. and Vanderbilt Ave.: John E. Donovan, Port Richmond, $16,939; Jos. Johnson's Sons, West New Brighton, $15,623; Michael Fitzgerald, 312 W. 141st St., N. Y. City, $15,106 (awarded contract); J. K. Summers, 255 E. 71st St., N. Y. City, $17,201, and E. A. Matthews, 21 Park Row, N. Y. City, $15,565. The detail bid of Michael Fitzgerald, the successful bidder, is as follows: 5,780 sq. yds. granite block, laid with paving cement joints, $2.55; 40 sq. yds. old block pavt., relaid, 25 cts.; 270 sq. ft. new bridgestone, 75 cts.; 150 lin. ft. new curb., 16-in.x4-in., 70 cts.; 500 lin. ft. old curb. reset, 10 cts.

Kingsbury, N. Y.—The Town Bd. is stated to have decided to macadamize the highway leading from Sandy Hill to Ft. Ann village line, a distance of 10 miles.

Syracuse, N. Y.—The following bids are stated to have been received by the Bd. of Contract and Supply on Apr. 24 for paving with asphalt portions of *a* Highland Ave. (1) with brick between the street railway tracks, (2) with sandstone between railway tracks, also a portion of *b* Fulton St., (3) with asphalt, (4) with brick: Warner-Quinlan Asphalt Co., (a—1) $24,166, (a—2) $25,140. (b—3) $11,961; F. J. Baker, (a—1) $24,174, (a—2) $25,147, (b—3) $11,810, (b—4) $12,360; Central City Paving Co., (a—1) $24,368, (b—4) $12,288, (a—2), $25,341; John W. Bustin, (b—4) $12,274; Troy Public Wks. Co., (b—4) $11,324; Thos. Marnell, (b—4) $11,194.

**Rochester, N. Y.*—H. N. Cowles, 47 Tacoma St., is reported to have received the contract for the Glendale Park pavement, Kushequa brick to be used, at $23,325.

Albany, N. Y.—The Bd. of Contract and Supply is stated to have opened bids May 1 for paving about 5,780 sq. yds. on Hudson Ave., price given per square yd. as follows: A. L. Norton $1.50, Mulderry Bros. $1.15, Robt. Shafer $1.19 and Albany Material & Constr. Co. $1.20.

Elmira, N. Y.—Bids will be received until May 22 by the Bd. Pub. Wks. for paving a portion of Maple Ave., as advertised in The Engineering Record.

**Columbus, O.*—Chas. H. Frank, Secy. Bd. Pub. Service, writes that the contract for constructing a macadam road in Perry Township (bids opened Apr. 12) has been awarded to Buckeye Eng. & Constr. Co., of Columbus, for $24,287.

Cincinnati, O.—The lowest bid opened on Apr. 24 for grading, curbing and macadamizing 2d Ave. was submitted by the L. Drach Constr. Co., of Cincinnati, for $5,945. Henkel & Sullivan, Library Bldg., submitted the lowest bid on Apr. 26 for grading, curbing and paving with granite block on Smith St. for $13,052.

Bids will be received May 29 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of Park Ave., by resurfacing with asphalt, etc.

Bids will be received June 2 by the Bd. Co. Comrs. for constructing a portion of Columbian Ave., in Columbia Township, with crushed stone and gravel; Eugene L. Lewis, Co. Aud.

Canton, O.—Bids will be received May 22 by the Bd. Pub. Service (C. A. Zellers, Clk.) for furnishing materials and improving portions of 3d, 4th and Mahoning Sts., by grading, curbing and paving with vitrified brick; bids on labor and material will be received separately. T. E. Myers, City Engr.

Alliance, O.—The City Council is stated to have passed a resolution providing for the paving with asphalt Cambridge St.

**Galion, O.*—Mack Gledhill, of Galion, is stated to have received the contract for constructing the Sulphur Springs and Plymouth pike roads for about $12,000.

Freeport, Pa.—See "Sewerage and Sewage Disposal."

Wilkesbarre, Pa.—The Street Com. of Council is stated to have recommended awarding the contract for street paving to the Mack Paving Co., of Philadelphia, at its bid of $25.20 per thousand for vitrified brick. The appropriation available for repaving is $204,000.

**Kennett Square, Pa.*—Jos. W. Hunter, State Com. of Highways, is stated to have awarded the contract for macadamizing 4 miles of road between Kennett Square and Avondale to Theo. Horsch, of Narberth, for $17,100.

**Erie, Pa.*—Mayer Bros., 1213 State St., are stated to have received the contract for repairing asphalt pavements during fiscal year for $1.25 per sq. yd. complete; topping with binder, 98 cts.; topping without binder, 72 cts. per sq. yd.

*The contract for repairing stone pavements is stated to have been awarded to Keefe & Beckman at 28 cts. per sq. yd. and 11 cts. per lin. ft. for stone curb.

**Pittsburg, Pa.*—The County Comrs. are stated to have opened bids on Apr. 24 for macadamizing the following roads: *a* Lovedale Road, *b* Washington Pike, *c* Pitcairn Road, *d* Imperial and Clinton Roads: W. E. Howley, Bijou Bldg., *a* $29,889 (awarded contract); *c* $37,887, *d* $82,854; J. T. Howley & Co., *a* $35,078; W. W. Kelley, *a* $50,083; Anchilles Arimadi, *a* $52,679; Keeling & Ridge, *a* $61,867, *c* $41,715, *d* $97,235; Wiley Bros., *a* $62,955; Ott Bros, 414 Washington Ave., *b* $12,995 (awarded contract); Booth & Flynn, 1942 Forbes St., *b* $15,210, *c* $28,486 (awarded contract), *d* $54,515 (awarded contract); F. F. Folkelson & Co., *c* $34,387; Hastings & Barrett, *c* $36,021; C. M. Driver, *d* $70,454; J. F. Collins, *d* $74,535; Foley Bros., *d* $96,465.

Woonsocket, R. I.—It is stated that Main and Cumberland Sts. will be paved at a cost of $30,000.

Jackson, Tenn.—The County Court is stated to have decided to expend an additional $150,000 for improving roads in Madison County.

**Salt Lake City, Utah.*—The detail bid of the Utah Fireproofing Co., the successful bidder for the construction of cement sidewalks (bids opened Apr. 10) is as follows: 10,000 cu. yds. excav., 35 cts.; 1,000 cu. yds. embkmt., 30 cts.; 200,000 sq. ft. 4-in. cement sidewalks, 11¾ cts.; 6,000 sq. ft. 6-in. cement sidewalks, 16 cts.; 10 M. ft. flumes, $40 per M. ft.; 2,000 lin. ft. guard timbers, 10 cts. Total bid, $29,230.

Richmond, Va.—Bids will be received by Capt. A. W. Butt, Q. M., U. S. A., Washington, D. C., until May 19, for repairing roadway to the National Cemetery, Richmond.

**Seattle, Wash.*—The following are the bids opened on Apr. 22 by the Bd. of Pub. Wks. for grading and concrete sidewalks on Franklin Ave. (bidders all of Seattle): Wm. Stanley & Co., $46,554; Hans Pederson, $40,981; Coast Concrete Co., $40,989; Frank & Brandon, $39,695 (awarded contract) and McAdam & Cannon, $44,558. The detail bid of Frank & Brandon, the successful bidders, is as follows: Fixed estimate, $1,500; lump sum, clearing and grubbing, $600; 50,000 cu. yds. earthwork, 24½ cts.; 226 M. ft. B. M. curbs and gutter, $16; 84 M. ft. B. M. crosswalks, $15; 18,200 sq. yds. concrete sidewalks, $1.05; 755 sq. yds. concrete alley crossings, $1.75; 5,500 lin. ft. three-inch pipe sewer, 1 ct.; 1,440 lin. ft. box drain, 25 cts., and 95 lin. ft. 8-in. pipe sewer, 80 cts.

Bids will be received May 13 by the Bd. Pub. Wks. (C. B. Bagley, Secy.) for laying concrete sidewalk in several streets, including Wallingford Ave.; estimated cost, $53,900; also for grading 24th Ave. N.; probable cost, $8,150.

Tacoma, Wash.—The following are the bids opened on Apr. 25 by Wm. Welsh, Comr. Pub. Wks., for paving K St. with asphalt, about 13,253 sq. yds. asphalt paving, with 15,200 sq. yds. 4-in. concrete base, 1,948 sq. yds. brick gutter, 6,931 lin. ft. cement curb, etc.: Barber Asphalt Paving Co., $37,490; Geo. Milton Savage, $37,380, and Warren Constr. Co., $40,200.

*The contract for constructing cement and plank sidewalks in district No. 241 is reported to have been awarded to W. J. Murphy for $12,473. Other brids received on Apr. 25 on the work were as follows: J. E. McHugh, $14,443; W. J. Murphy, $12.473; Geo. Milton Savage & Co., $12,650; Jas. Lee, $13,998, and L. A. Belfoy & Co., $12,797.

**Racine, Wis.*—The Bd. of Pub. Wks. is stated to have opened the following bids on Apr. 22 for paving a portion of State St.; *a* for asphalt, price given per sq. yd., *b* for curb and gutter, price given per lin. ft.: N. T. Reichert, Jr., *a* $2.25, *b* 65 cts.; Barber Asphalt Paving Co., *a* $1.79, *b* 45 cts., manhole covers, $5.50 each (awarded contract); R. T. Connelly Co., *a* $2.05, *b* 50 cts., manhole covers, $6 each; McCarthy Improv. Co., *a* $2.10, *b* 48 cts., manholes, each $7; Harding & Nelson, *a* $2.29, *b* 66 cts.; John O. Jones, *a* $2.10, *b* 66 cts., manhole covers, $6.50 each. The quantities required are 13,387 sq. yds. paving and 5,650 lin. ft. of combined curb and gutter.

Items marked thus give the names of parties awarded contracts.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Ventura, Cal.—The Town Clk. writes that it was voted Apr. 22 to construct water works and an electric light plant.

Washington, D. C.—Bids will be received by Lieut.-Col. Smith S. Leach, Corps Engrs. U. S. A., 1,000 22d St. on May 20, for furnishing and installing complete electric lighting equipment for the Washington filtration plant, as advertised in The Engineering Record.

Tarpon Springs, Fla.—L. R. Fernald, City Clk., writes that it is proposed to construct an electric light plant and ice factory, at a cost of $6,000. Address N. F. McDonald, engr. in charge.

Ocala, Fla.—The Florida Power Co. is reported incorporated with a capital of $300,000 by W. N. Camp, R. F. Brewer, G. D. Munsing and others.

St. Augustine, Fla.—Gen. Foster is reported to have petitioned Council for a franchise for an electric light plant.

Kankakee, Ill.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Washington, D. C., until May 26, for the wiring, for incandescent lighting, complete, at the U. S. Post-Office here.

Nokomis, Ill.—The Henry Electric Light & Power Co., of Nokomis, is reported incorporated with a capital of $20,000 by John H. Crickenberger, Fred W. Potter and Chas. A. Onyum.

Connersville, Ind.—It is reported that the Connersville Light, Heat & Power Co. will expend about $25,000 in improvements.

Frankfort, Ind.—The Indiana Hydraulic Co. is reported organized, with Eugene Rush, Pres., and N. W. Hanna, Secy., both of Frankfort. The company will be incorporated with a capital of $2,000,000 and will manufacture electricity. It will get its power from Wildcat Creek. A dam 30 ft. high and 368 ft. long, of solid cement, will be constructed.

Monticello, Ind.—The Tippecanoe Hydraulic Co. is reported organized to utilize the water power of Tippecanoe River, capital $800,000. It is proposed to construct four power plants, one at Norway, another at Tioga, another at Oakdale and the fourth at Springboro. Work is about to begin at the plant at Norway, which will cost about $195,000. The company proposes furnishing power to Lafayette, Logansport and Frankfort. A. A. McKain, of Indianapolis, and C. D. Meeker and D. W. Thompson, Jr., of Frankfort, are reported interested.

Indianapolis, Ind.—It is reported that the Bd. Pub. Wks. will receive bids until May 15 for naptha and gas incandescent street lights; all-night schedule for outside districts.

Winfield, Kan.—The citizens are reported to have voted Apr. 20 to issue $15,000 bonds to complete the electric light plant.

Danville, Ky.—See "Electric Railways."

Georgetown, Ky.—The Georgetown Water, Gas, Electric Light & Power Co. is reported reorganized, and will add a steam heating plant and a new gas plant. F. X. Long, Newport, and S. L. Allen, Georgetown, are among the incorporators.

Nantucket, Mass.—A charter is reported to have been granted to the Citizens' Gas, Electric & Power Co., of Nantucket.

Alpena, Mich.—The following are the totals of bids opened on Mar. 25 for the construction of an electric light plant (Engineer, John H. Blomshield, Bay City): (1) complete price, including engine 150 r.p.m.; (2) complete price, including engine 120 r.p.m.; (*a*) Scotch boiler; (*b*) water tube boiler: Ft. Wayne Electric Co. (2-*a*) $58,629, (2-*b*) $56,852; Stanley Electric Co. (1-*a*) $55,188, (1-*b*) $53,411; Westinghouse Electric Co., (1-*a*) $58,561, (1-*b*) $56,784; the Bullock Electric Co. (1-*a*) $54,102, (1-*b*) $52,325, (2-*a*) $56,644, (2-*b*) $54,867; General Electric Co., (2-*a*) $62,929, (2-*b*) $61,152; Arbuckle Ryan Co., (1-*a*) 2 bids, $63,505 and $67,780, (1-*b*) 3 bids, $56,680, $61,330 and $65,605, (2-*a*) 2 bids, $67,780 and $73,370, (2-*b*) 2 bids, $65,605 and $71,195; the Westinghouse Co. bid on steam turbines (1-*a*) $70,453, (1-*b*) $68,676, and the Turbine Engine Co. bid on steam turbines (1-*a*) $54,497, (1-*b*) $54,720.

Gibbon, Minn.—This town is reported to be considering the construction of an electric light plant.

Marshall, Minn.—It is reported bids will be received May 13 by John R. Gray, City Recorder, for installing a new boiler at the city power plant.

Laurel, Miss.—The Laurel Improv. Co. is reported to have accepted the franchise offered by the city and will begin at once the construction of a light and power plant, at a cost of $25,000.

Ft. Hancock, N. J.—It is stated that bids will be received until May 20 by Abe. S. Bickman, Q. M., U. S. A., for installing electric lighting fixtures in 5 buildings here.

New York, N. Y.—Plans have been filed for a tank for the West Harlem plant of the Consolidated Gas Co. to be constructed east of 12th Ave., from 132d to 133d Sts. It is to be 196 ft. diam., with a capacity of 5,000,000 cu. ft. Its cost is estimated at $34,000 by architects, Bartlett, Heyward & Co., of Baltimore, Md.

Bids will be received May 15 by C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment in School No. 85, Boro. Manhattan.

**Long Island City, L. I., N. Y.*—The contract for installing the electric equipment in School No. 71, Queens Boro. (bids opened May 1) has been awarded to T. Fred. Jackson, 592 Columbus Ave., N. Y. City, for $6,096.

York Haven, Pa.—The York Haven Water & Power Co. (W. F. B. Stewart, Vice-Pres., York) is stated to have decided to extend its lines to Lancaster County and in Dauphin County.

**Watkins, N. Y.*—The Water and Sewerage Comn. is reported to have awarded contracts as follows on Apr. 26 for the municipal electric light plant: 2 pumps, condenser and feed-water pump, to the Dean Pump Co., $3,055; 140-hp. engine, to Shepard Engine Co., $1,905; brick smokestack, to M. W. Kellogg & Co., $1,190; 2 vertical boilers, Fitzgibbons Boiler Co., $4,051; 2 generators and motors, to Stanley Electric & Mfg. Co., $3,717; 65 arc lamps and 2 regulators, to Adams-Bagnall Co., $1,390, and wire and cable, to H. C. Roberts Electric Supply Co., $1,522.

Syracuse, N. Y.—The Municipal Htg. Co. is reported to have decided to increase the capacity of its generating plant in Pearl St. and to lay some additional mains.

Niagara Falls, N. Y.—A bill was passed in State Senate, May 3, providing for the construction of power plants at Niagara Falls.

Oswego, N. Y.—Bids will be received by the Dept. of Water (F. W. Ormsby, Secy.) on May 18 for furnishing the necessary generators, motors, transformers and other electrical equipment for the Lake water extension, as advertised in The Engineering Record.

Williston, N. D.—D. C. Page, City Aud., writes that the subject of constructing water works and an electric light plant will probably to taken up in about 30 days.

Columbus, O.—The Columbus Public Service Co. (Chas. L. Kurtz, Pres.) is reported to have voted to increase its capital an additional $250,000 to be used in increasing the capacity of the plant at 17th and Mound Sts., and in extension of the hot-water system into sections on the East Side.

Bids will be received by the Trus. of the Sinking Fund (Martin A. Gemunder, Secy.), until May 12, for the following bonds: $18,000 electric light supply, $142,000 water purifying and softening works, $150,000 sewage disposal works, and $50,000 city's proportion of public improvement bonds.

Hamilton, O.—Press reports state that the Hamilton Gas & Electric Co. will expend about $500,000 in improving the plants recently acquired through a merger of the Hamilton-Otto Coke Co., the Hamilton Electric Light Co. and the Hamilton Gas & Coke Co. The improvements consist of a new electric plant, a new gas holder of 500,000 cu. ft. capacity, a new carburetor, additional gas mains, new overhead construction for electric service and general enlargement of the three plants.

Springfield, O.—The People's Light, Heat & Power Co. (Chas. Johann, Engr.) is about to let contracts for improvements to cost about $150,000.

Cincinnati, O.—Plans have been submitted to Bldg. Inspector Tooker by the Cincinnati Gas & Electric Co. for a 1-story retort house to be constructed on Front and Park Sts., to cost about $75,000. It will be of steel and brick construction.

Philadelphia, Pa.—Bids will be received until May 22 by Lieut. Col. Frank Heath, Comdg., for furnishing supplies, during year ending June 30, 1906, for Frankford Arsenal, as follows: Electrical supplies, steel, iron, iron bronze, steel and aluminum castings, tin, zinc, lead and antimony, plumbing, steam fitting, etc.

**Pittsburg, Pa.*—The contracts for the electrical construction work and apparatus for the filtration plant being constructed at Aspinwall, are stated to have been awarded to the Morganstern-Ochiltree Co., of Pittsburg. It includes the installation of a complete power and lighting system, telephone exchange, police and time clock systems. All the power, lighting and telephone cables will be placed underground, conduits to include cables sufficient for suppying power to about 20,000 lights.

Oxford, Pa.—Bids will be received May 17 by Jas. D. Burn, Pres. Citizens' Gas & Fuel Co., Oxford, for the complete installation of the new gas plant, including holder, gas apparatus, street mains, etc.

Central Falls, R. I.—Wm. H. Goldsmith, Clk. Lighting Com., writes that this city contemplates constructing a municipal heat, light and power plant of 185-arc lights and 500 incandescent lights.

Harriman, Tenn.—Press reports state that H. A. Coles, of Atlanta, Ga., has prepared estimates for a new electric light plant for Harriman. He estimates the cost at $40,000.

**Nashville, Tenn.*—The Braid Electric Co., 234 N. Market St., is reported to have secured the contract for furnishing and installing a complete 400-hp. generating set in the city lighting plant (bids opened Apr. 18) for $11,995.

Marble Falls, Tex.—M. H. Reed is reported interested in the construction of an electric light and power plant to be constructed here at a cost of $160,000. No engineer chosen yet.

Newmarket, Va.—The Council is reportel to have granted Rice Snapp a franchise to construct and operate an electric light plant.

Ashland, Va.—Chas. Stebbins, City Secy-Treas., writes that bids will be opened on May 18 for a franchise for an electric light plant.

Goldendale, Wash.—H. W. Fellows, of Spokane, is reported interested in the construction of an electric light plant at Goldendale, to cost about $50,000. Power to be developed from the falls of the Little Klickitat.

Prosser, Wash.—The Prosser Falls Land & Power Co. is reported to have decided to develop the water power of Columbia River at Priest Rapids.

Marlinton, W. Va.—The Marlinton Light & Water Co. (John Alexander, Pres.) proposes constructing water works and an electric light plant here.

Ligonier, Ind.—R. E. Jeannerd, City Clk., writes that the only bid received on Apr. 27 for lighting the city for a period of 10 yrs. with 40 or more 2,000 c.p. inclosed arc lamps was submitted by the Ligonier Electric Light Co.

Onalaska, Wis.—The Wisconsin Light & Power Co. (J. Geo. Schweizer, Secy.) has petitioned City Council for a franchise for an electric light and gas plant.

Burlington, Wis.—John Pieters, Chmn. Electric Light Com., writes in regard to the construction of an electric light plant for which the citizens recently voted to issue $8,000 bonds, that the Council is taking steps to construct a plant of fifty 2,000-c.p. lights.

Milwaukee, Wis.—The Milwaukee Gas Light Co. will submit to the Building Inspector detailed plans for the erection of new gas tank.

Edmonton, Alberta, N. W. Ter.—Bids will be received until May 15 by J. H. Hargreaves, Pub. Wks. Comr., for wire, transformers, switchboard and all material necessary for the installation of series arc lighting.

Napanee, Ont.—W. A. Grange, Town Clk., writes that it is proposed to construct a municipal electric light plant to cost about $40,000, but nothnig definite has yet been done.

Parry Sound, Ont.—G. Groves, Electrical Supt., writes that it is proposed to install a 400-kw., 2,080-volt, 60-cycle, 3-phase revolving field alternator, speed not over 400 r.p.m.; also switchboard and a 22-kw., 125-volt exciter with waterwheel, also waterwheel governor.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Willimantic, Conn.—The Railroad Com. of the State Legislature is stated to have reported favorably on a bill authorizing the Willimantic St. Ry. Co. to extend its lines through Coventry, South Coventry and Bolton to Manchester.

Atlanta, Ga.—A charter was granted by State Secy. Cook on Apr. 19 to the Atlanta, Birmingham & Atlantic R. R. Co., which has already acquired much of the necessary right of way and will build a line from Montezuma, Ga., through LaGrange in Troupe County, to Birmingham, Ala., a distance of 241 miles. The company will build another line from Atlanta to a connection with the Montezuma line at or near Wedowee, Ala., a distance of 75 miles. The road will be built by the Atlanta & Birmingham Constr. Co. under contract, this company having been recently incorporated here with a capital of $3,000,000, while the capital stock of the railroad company is only $100,000. H. M. Atkinson, of Atlanta, is reported to be the chief promoter.

Connersville, Ind.—It is stated that the Valley Traction Co. proposes constructing a line from Connersville to Brookville. J. E. Jeffries is reported to be considering the construction of a local street railway in Connersville.

Ottumwa, Ia.—The Eldon & St. Louis Ry. Co. (J. E. Houghland, Secy.) is stated to have decided to construct an electric railway from Ottumwa to Jefferson City, Mo., Chicago parties having purchased the properties of the company, which consist of a few terminal rights in Eldon, and complete surveys via Jefferson City to St. Louis. They propose to use the right of way for the new enterprise. A survey of the track from Eldon to Ottumwa has already been made, the same running on the west side of the Des Moines River in a northwesterly direction to Ottumwa. The interested parties have already made arrangements for the use of the Wabash bridge at Ottumwa, and will enter Eldon from north and west over the wagon bridge at that point. The company expects ultimately to extend the line from Jefferson City to St. Louis, and from Ottumwa via Wright and Oskaloosa to Des Moines.

Iowa Falls, Ia.—The Peterson Heat, Light & Water Co., of Des Moines, is reported to be considering plans for the construction of an electric interurban line from Iowa Falls to Allen, a distance of seven miles.

Danville, Ky.—The Danville Light, Power & Traction Co. is reported organized. Chas. C. Fox, Pres. Arnold Honegger, of St. Louis, Mo., Sec., Treas. and Gen. Mgr. It is stated that work will be begun soon upon an electric light plant for the city, and after that has been completed a street car line will be constructed which will eventually be run over to connect with the Louisville & Nashvile Railroad at Junction City, the right of way having already been granted by the county for this interurban route.

Lewiston, Me.—The construction of an electric railway from Lewiston to Portland, via the towns of New Gloucester, Gray, Cumberland and Falmouth, is reported under consideration. The length of the line will be 30 miles, standard gauge. The capital of the company is $50,000. Winfield S. Libby, Harry M. Dingley, Julius E. Parkhurst, all of Lewiston, are reported interested.

Cambridge, Mass.—The City Council is reported to be in favor of a four-track subway from the new West Boston bridge to Howard Sq., instead of the elevated structure now provided by law.

Woodville, N. Y.—Geo. H. Switzer, of Bath, is reported interested in the proposed electric railway between Atlanta and Woodville. The franchises have all been granted and the necessary consents of property holders secured. The road will be 11 miles long, 4 ft. 8½-in. gage, equipped to carry passengers, freight, express and mail.

Creston, O.—It is stated that the Barberton, Wadsworth, Creston & Western Traction Co. will construct a line from Barberton to Mansfield. The proposed road will run from Barberton to Wadsworth, Rittman, Sterling, Creston, Burbank, West Salem and paralleling the Erie to Mansfield. The entire right of way is reported to have been secured from Barberton to Wadsworth and partially to Rittman, and parties are at work securing right of way along the route for the proposed line.

Bucyrus, O.—Chas. Linn is stated to have in contemplation the construction of an electric railway from Marion to Bucyrus.

Columbus, O.—The Columbus, Delaware & Marion Ry. Co. is reported to be preparing to extend its lines from Marion to Galion, to form a portion of the connecting link of electric railway which will give a through service from Cincinnati and Columbus to Cleveland.

Fostoria, O.—S. P. Douglas, of Toledo, is stated to have under consideration the construction of an interurban line from Fostoria to North Baltimore, through Bloomdale and Bairdstown.

Kenton, O.—The Sandusky & Southwestern Traction Co., of Ohio, is reported reorganized and is getting ready to complete the line from Wapakoneta to Kenton, a distance of 36 miles. ⅔ of the grading is finished. The projected line from Wapakoneta to Sandusky is about 100 miles.

Steubenville, O.—The Tri-State Traction Co. is stated to have received a franchise to build its line from Wellsburg to Follansbee, which means that the line will be extended on up the river to Steubenville.

Sayre, Pa.—The Sayre & South Waverly Electric Ry. Co. is stated to have received a franchise to build an electric railway through Sayre. The Sayre & South Waverly Electric R. R. Co. is the Pennsylvania end of the Chemung Valley Traction Co., and is the one recently organized to build an electric railway from Elmira to Waverly, thence to Sayre, Pa.

New Castle, Pa.—The Western Pennsylvania Motor Power Co. is reported organized to construct a huge system of interurban trolley lines throughout Lawrence, Butler, Mercer and Beaver Counties. Incorporators are Alex. J. Barron, Wm. L. Alen and Ralph L. Smith. It is said that connections will be made to Pittsburg.

Harrisburg, Pa.—Duquesne & Lincoln Place Ry. Co. is stated to have received a charter to build 4 miles of line in Allegheny County from Lincoln Place to Duquesne. Capital is $25,000. J. C. Lange, of Pittsburg, Pres.

****Items marked thus give the names of parties awarded contracts.***

It is reported that the Ambridge & Borough St. Ry. Co., with a capital of $9,000, has received a charter to build 1½ miles of line in Ambridge. Jas. S. Campbell, pres.

York, Pa.—The York County Traction Co. is reported to have decided to extend the Red Lion and Windsor line from its present terminus in the town of Windsorville to the Susquehanna River, a distance of 6.5 miles.

Corry, Pa.—It is stated that C. P. Northrup & Co., of Boston, are considering the construction of an electric railway from Corry to Findley's Lake, a distance of 19 miles. The cost will be about $140,000.

Philadelphia, Pa.—It is stated that the Philadelphia Rapid Transit Co. will soon award the contract for constructing an addition to its power house on Wyoming Ave., near 3d St. The plans provide for a concrete steel and brick structure 70.9 by 45 ft., to cost $20,000. W. S. Tinning, Ch. Engr.

Altus, Okla. Ter.—The Wildman Central & Wichita Mountain Ry. Co. is reported incorporated with a capital of $2,000,000 to construct a steam and electric railway from Altus, or Mangum, crossing the Blackwell, Enid & Southwestern Ry. at a point between Snyder and Roosevelt and extending to Wildman and through the Wichita mountains to a point on the Indian territory line, between Duncan and Comanche; approximate length of proposed route 100 miles. Incorporators: Geo. R. Ray, of Wildman; F. R. Wildman, of Blair, and R. Burdge, of Ft. Worth, Tex.; E. A. Tucker, of Dallas, Tex., and others.

**Portland, Ore.*—The Atlas Contract & Supply Co. of San Francisco, Cal., is stated to have been awarded a contract amounting to about $200,000 for the construction of 3½ miles of double track electric railway for the Oregon Traction Co. Contracts have not been closed for the remainder of the projected 26-mile line to Forest Grove.

Uniontown, Pa.—It is stated that the Uniontown & Monongahela Valley Electric Ry. Co. has decided to construct the following extensions from a point of the Uniontown & Monongahela Valley Electric line in German Township, at the intersection of the township road leading from Leckrone to Smithfield and thence run on by way of Leckrone to Masontown; thence to New Geneva, through Nicholson Township, and other districts in that section, and finally to the place of beginning. Another of the proposed extensions is to begin at a point on the charter right of the company at or near Oliphant and cut across to High House, Walnut Hill and other places in that vicinity, thence on to Fairchance, Smithfield and other places in that section. A third extension agreed upon is to begin at a point in the lines of the company in German Township and take in Footedale, New Salem, Morristown and other points in that part of the county, finally intersecting with the National pike at a point near Brownsville.

Port Arthur, Ont.—Bids are being received by J. McTeigue, Secy. of the Electric Ry. and Light Comrs., for the following electric machinery: One 150-hp. Wheelock compound condensing engine, one 80-hp. boiler, shafting, pulleys and belting, one 500-volt 45-kw. railway generator, one 60-kw., 2000-volt, 125-cycle alternator, with necessary switchboard and attachments.

Walkerville, Ont.—W. F. Brown asks tenders for construction of the railway of the Windsor & Tecumseh Electric Ry. Co.

RAILROADS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—C. D. Smith & Co. and J. D. Lewis, of Memphis, Tenn., are reported to have secured the contract to construct 70 miles of road for the Birmingham Ry. bet. Birmingham and Montezuma, Ga.

Pine Bluff, Ark.—With a capital of $600,000, a company has been incorporated to build a railroad from Pine Bluff to Lonoke, a distance of 46 miles, to be known as the Pine Bluff, North & South R. R.

Wilmington, Ark.—The Louisiana & Pine Bluff Ry. Co. is reported incorporated with a capital of $300,000, to construct a road 20 miles long from Huttig to Wilmington.

Danbury, Conn.—The New York, New Haven & Hartford R. R. Co. (C. M. Ingersoll, Ch. Engr., New Haven) is reported to be surveying for a line between Danbury and East Portchester, N. Y.

Harrisburg, Ill.—The Harrisburg Ry. Co., of Chicago, is reported incorporated with a capital of $50,000 to construct a line through the counties of Saline and Williamson to Harrisburg, Marion, Herron, Carerville, and Johnston City to the western boundary line of Williamson County. Incorporators: Arthur W. Underwood, Evanston, Ill., Nathan S. Smyser, M. S. Somerville, of Chicago, Ill.

**Indianapolis, Ind.*—Kiser & Co., of Terre Haute, are reported to have secured the contract for constructing the first 20 miles of the Indianapolis Division of the Southern R. R.

**Sioux City, Ia.*—The contract for the extension of the Great Northern R. R. from Sioux City to Ashland, Neb., is stated to have been awarded to Peter Sims, of St. Paul.

Des Moines, Ia.—The Chicago & Northwestern Ry. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.) is reported to have completed preparations for double tracking a branch line between Des Moines and Ames.

Jersey City, N. J.—The improvements contemplated in Jersey City by the Erie R. R. Co. (F. L. Stuart, Ch. Engr., New York, N. Y.) are reported to include a new passenger station and ferry house at 12th St. and an open cut through Bergen Hill in place of present tunnel; probable cost of improvements contemplated reported to be $8,000,000.

Hillsboro, O.—Engineers of the Baltimore & Ohio Southwestern Ry. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.) are reported to have commenced a preliminary survey of the proposed extension of the Hillsboro branch directly eastward to a junction with the main line at Chillicothe.

**Philadelphia, Pa.*—Contracts amounting to about $1,000,000 are reported to have been awarded by the Pennsylvania R. R. Co. for the improvement of the Buffalo & Allegheny Grand Division. The successful contractors are Drake & Stratton, the Millard & McGraw Co. and C. A. Sims & Co., all of Philadelphia. Each contracting firm has been given separate work.

Manila, P. I.—Contracts will probably be let before long by the U. S. Government for the construction of railways in the Philippines. The construction will, it is stated, approximate about 1,000 miles, of which 700 will be built on the Island of Luzon and the remainder to be divided between the Islands of Panay, Cebu, Leyte and Samar. F. A. Delano, of Chicago, Ill., vice-pres. Wabash R. R. Co., is reported to be drawing up the prospectus which will govern the bidding.

Harriman, Tenn.—The Frisco R. R. (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) is reported to be considering the extension of the Tennessee Central R. R. from Harriman to Bristol, by way of Knoxville.

Guaymas, Mex.—The Mexican Government is reported to have granted a concession to Thomas McManus, representing the Cananea, Yaqui River & Pacific R. R. (E. A. McFarland, Ch. Engr., Tucson, Ariz.), to build a line from Guaymas, north to the American border and southeasterly from Guaymas, touching Agiabao and Topolobam and Topolobampo.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Prattville, Ala.—Bids will be received May 10 by G. S. Livingston, Judge of Probate, for erecting a courthouse; probable cost, $40,000. Separate bids will be received same date for erecting a Co. jail; probable cost, $12,000. Bruce Architectural Co., Archts., Birmingham, Ala.

Montgomery, Ala.—It is reported that bids are wanted until May 15 for erecting 2 fire-engine houses in W. Montgomery and West End; Ausfeldt & Chapman, archts., Moses Bldg.; R. S. Williams, City Treas.

**Tuskegee, Ala.*—M. B. Abercrombie, Judge of Probate, writes that the contract for erecting a court house (bids opened Apr. 28) has been awarded to C. C. Totherow & Co., of Birmingham, for $42,300.

Ft. Smith, Ark.—It is reported that the Ft. Smith Public Library Assoc. has been formed for the purpose of erecting a library to cost about $25,000.

Highland, Cal.—The Bd. of Mgrs. of the State Hospital, it is stated, intends erecting an addition to the hospital at a cost of $65,000. Lyman King, of Redlands, is Secy. of the Bd.

San Francisco, Cal.—The Bd. of Health, it is stated, intends erecting a hospital for contagious diseases which is to cost about $75,000. Dr. J. B. Kennedy is Pres. of the Bd.

Jacksonville, Fla.—The erection of a city hospital at a probable cost of $50,000 is reported under consideration.

Caldwell, Idaho.—Wayland & Fennell, of Boise, it is stated, have been selected to prepare plans for the court house which is to be erected here at a probable cost of $65,000.

Clinton, Ill.—It is reported that Dr. John Warner has decided to erect a $35,000 hospital.

Kankakee, Ill.—Bids will be received May 29 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for a low pressure heating apparatus in the U. S. Post Office here.

Lafayette, Ind.—It is reported that bids are wanted until May 16 for erecting a building for widows at the Indiana State Soldiers' Home (B. Fulwiter, Secy.); separate bids will be received for heating and plumbing.

Plaquemine, La.—Bids will be received by the Bd. of Police Jurors (A. H. Gay, Pres.) on June 10 for the erection of a court house in Plaquemine from plans of A. J. Bryan, of New Orleans, as advertised in The Engineering Record.

Baltimore, Md.—The Bd. of Pub. Improv., it is stated, has appropriated $25,000 for the erection of a municipal hospital for infectious diseases.

The following are reported to be the bids received for erecting engine house No. 26: C. Sheehan & Sons, $23,460; Henry Rippel, $21,660; W. F. Shinnick & Co., $19,763; J. A. Sheridan & Co., $21.700; C. L. Stockhausen, $21,497; M. C. Davis, $22,015.

The Centre Market Comn. has approved the plans for the new Maryland Inst. and retail market building which is to be erected in Centre Market Space at a cost of about $215,000.

An ordinance has passed first branch of the City Council appropriating $32,000 for the purchase of a site and the erection of an engine house in the vicinity of Preston St. and Guilford Ave.

Brockton, Mass.—It is reported that W. V. Howard, City Archt., has completed plans for the armory which is to be erected on Warren Ave. at a cost of $30,000.

Amesbury, Mass.—Bids will be received by the Superv. Archt., Washington, D. C., June 8 for the construction complete of U. S. Post Office at Amesbury, as advertised in The Engineering Record.

**Marlboro, Mass.*—The following are reported to be the bids opened by the Massachusetts Army Comrs. at Boston on Apr. 22 for erecting an armory for Co. F. 6th Regt. M. V. M., at Marlboro: Thos. P. Hurley, Marlboro, $22,867 (awarded contract); Geo. J. Andrews, Marlboro, $23,591; Alex. McDonald, $32,722; J. E. Warren & Co., Marlboro, $25,194; C. H. Andrews, Marlboro, $26,903; E. L. Cummings, Boston, $25,587, and Mead & Mason, Boston, $27,886.

Flint, Mich.—The following are the bids opened on Apr. 29 by the Superv. Archt. Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office at Flint, not including heating: Edw. Henry, Tipton, Ind., $52,300; E. W. Reid & Co., Flint, $46,800; General Constr. Co., Milwaukee, Wis., $48,847; Geo. Rickman's Sons, Kalamazoo, $49,000; C. E. Carson, Chicago, Ill., $47,993; Northern Constr. Co., Milwaukee, Wis., $51,943; W. J. Turner Co., Chicago, Ill., $46,973, and Barnes Bros., Marion, Ind., $55,000.

Fergus Falls, Minn.—The Fergus Falls Hospital, it is stated, has received an appropriation of $75,000 to erect a nurses' dormitory.

Winona, Minn.—It is stated that the Soldiers' Home has received $75,000 to erect a new building for the ex-soldiers and sailors and their wives and widows.

**St. Paul, Minn.*—Newman & Hoy, Chamber of Commerce Bldg., it is stated, have received the contract to erect a 2-story and basement brick building at the city and county hospital which is to be used as a home for the nurses, and is to cost, exclusive of the plumbing and heating, about $23,497.

The Bd. of Control, it is reported, is seeking a site on which it is proposed erecting buildings for the State Prison, $75,000 having been appropriated by the State Legislature for the purchase of a site and the erection of the buildings.

Great Falls, Mont.—John E. Moran, City Clk., writes that the citizens voted Apr. 3 to issue $10,000 bonds for installing a public bath.

Ft. Missoula, Mont.—Bids will be received May 16 by Lieut.-Col. Wm. W. Robinson, Jr., Ch. Q. M., St. Paul, Minn., for constructing a brick storehouse here.

Reno, Nev.—Bids will be received June 7 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction, complete, of the U. S. Post Office here.

Portsmouth, N. H.—Separate bids will be received May 15 by the Q. M., U. S. Marine Corps, Washington, D. C., for constructing a boiler house and bakery, and an addition to the present barracks at the Navy Yard, Portsmouth.

Trenton, N. J.—It is stated that bids will be received by the Prison Comn. (M. E. Berry, Secy.) until May 20, for erecting an addition to the State Prison; probable cost, $300,000.

Jersey City, N. J.—Bids will be received May 24 by the Bd. of Health (C. K. Dickinson, Pres.) for furnishing material and erecting a hospital on Baldwin Ave. near Montgomery St., including ventilating and heating, plumbing, water supply, gas fitting, elevator and electrical work; Clinton & Russell, Archts., 32 Nassau St., New York City.

Kings Park, L. I., N. Y.—Bids will be received by the State Comn. in Lunacy, Albany, on May 17 for completing the unfinished construction and plumbing contracts on Nurses' Home at the Long Island State Hospital, Kings Park, as advertised in The Engineering Record.

Utica, N. Y.—Bids will be received by the Bldg. Com., Bd. Co. Comrs. (F. T. Proctor, Chmn.) until May 16, for furnishing material and erecting a court house at Elizabeth, Charlotte and Mary Sts.

It is reported that $96,000 is available for the replacing the stone building at either end of the old parade grounds at Madison Barracks.

Ft. H. G. Wright, N. Y.—Bids will be received May 17 by the Constr. Q. M., New London, Conn., for dredging and constructing a boat house at Ft. H. G. Wright.

West Point, N. Y.—The following are the bids opened on Apr. 20 by Maj. J. M. Carson, Jr., Q. M., U. S. M. A., for the construction of certain buildings at West Point: (*a*) Cadet barracks complete, (*b*) Cadet barracks, construction proper, (*c*) Captains' quarters, complete, (*d*) Captains' quarters, construction proper (*e*) Lieut.'s quarters complete, (*f*) Lieut.'s quarters, construction proper: John Pierce Co., 270 Bway., N. Y. City, *a*, $439,000, and $143,000 to be deducted if north wing is omitted, *c* $107,192, *c* $257,836; Mosier & Summers, 1266 Seneca St., Buffalo, *b* $366,800 and $118,000 to be deducted if north wing is omitted, *d* $71,547, *f* $166,026; Buckley Realty Constr. Co., Times Bldg., N. Y. City, *a* $478,000, and $105,000 to be deducted if north wing is omitted, *c* $115,000, *c* $260,000; P. J. Carlin Constr. Co., 1 Madison Ave., N. Y. City, *a* $489,000, and $150,000 to be deducted if north wing is omitted; John H. Parker Co., 225 4th Ave., N. Y. City, *b* $406,979, and $94,626 to be deducted if north wing is omitted, *d* $79,554, *f* $203,978; Denniston & Co., Rochester, *b* $307,300, *d* $69,358, *f* $188,461; Fissel & Wagner, St. James Bldg., N. Y. City, *c* $122,054, *e* $268,527; Jas. F. Disken, 114 E. 23d St., N. Y. City, $141,325; Jas. E. Leamy & Co., Syracuse, *b* $359,547 and $123,600 to be deducted if north wing is omitted, *d* $74,089, *f* $165,361; Morris Kantrowitz, 78 State St., Albany, *d* $81,451, *f* $266,442, or will do construction proper of all the officers' quarters if taken together for the sum of $330,499; Broderick & Wind Eng. & Constr. Co., 1 Madison Ave., N. Y. City, bid $622,500 for barracks and officers' quarters, complete, and will deduct $115,000 if north wing is omitted; Richard E. Heningham, 4-5 Court Sq., Brooklyn, bid $849,954 for the barracks and officers' quarters, complete, $498,668 for the barracks, complete, and will deduct $148,535 if north wing is omitted; Collins Bros., Bensen Bldg., bid $1,010,535 for barracks and officers' quarters, complete, and will deduct $172,878 if north wing of barracks is omitted; and V. J. Hedden & Sons Co., N. Y. City, bid $870,406 for the barracks and officers' quarters, complete, and will deduct $133,460 if north wing of barracks is omitted.

Kingston, N. Y.—It is stated that the Legislature has appropriated $30,000 for improvements to the armory on B'way.

Oswego, N. Y.—The Senate has passed a bill appropriating $75,000 for the erection of an armory here.

Tompkinsville, N. Y.—Bids will be received until May 29 by Lieut. Col. Wm. T. Russell, Corps. Engrs., U. S. A., for furnishing material and constructing the lamp shop, light house depot, Tompkinsville.

**Cincinnati, O.*—C. F. Lakeman, Secy. Bd. Public Safety, writes that the contract for erecting a 2-story engine house on Court St. (bids opened Apr. 20) has been awarded to L. P. Hazen & Co., of Cincinatti, for $38,407.

Cleveland, O.—It is stated that the Library Bd. has selected a site at Crawford road and Hough Ave. and proposes erecting a branch library to cost $35,000. It is reported that no archt. has been selected as yet. It is also reported that the Bd. intends erecting a branch library on Rhodes Ave. near Lorain St.

Columbus, O.—The erection of a fire house in the wholesale dist. in the vicinity of 3d and Spring Sts., to cost $50,000, is reported under consideration.

**Mansfield, O.*—Fred. S. Marquis, Secy. Bd. Mgrs. Ohio State Reformatory, writes that the following contracts have been awarded (bids opened Apr. 19): boilers to the Atlas Engine Wks., of Indianapolis, Ind., for $8,100 and stokers to the Pittsburg Stoker & Mfg. Co., of Pittsburg, Pa., for $3,600.

Youngstown, O.—It is stated that $28,000 hospital bonds have been sold.

**Items marked thus give the names of parties awarded contracts.*

Celina, O.—It is reported that bids will be received by the Library Bd., until May 13, for erecting a stone library.

**Philadelphia, Pa.*—A building permit has been granted to Henderson & Co., 1221 Arch St., to erect a branch library at Frankford road and Overington St. to be 1-story and basement of brick and terra cotta and to cost $50,000.

*Henderson & Co., 1221 Arch St., it is reported, have received the contract for erecting a scarlet fever hospital and a diphtheria hospital, stable and disinfecting plant at a total of $854,813, and Doyle & Doak, 1509 Sansom St., the contract for the erection of a main building for the Home for the Indigent at $664,016. Bids received for this work May 1.

Bids will be received until May 31 by Maj. J. C. Sanford, Corps. Engrs., U. S. A., Philadelphia, for constructing a light house, oil house, boat house, etc., at Reedy Island Range Front Light Station, Del.

**Pierre, S. D.*—T. M. McGuire, of Minneapolis, Minn., has secured the contract for installing heating apparatus in U. S. Post-Office at Pierre (bids opened Apr. 25) for $3,889.

Deadwood, S. D.—J. R. Warren, Deputy Co. Aud., writes that the plans prepared by C. E. Bell of the firm of Bell & Detweiler, of Minneapolis, have been accepted for the court house for Lawrence County. Probable cost, $100,000.

Memphis, Tenn.—Bids will be received May 22 by the Courthouse Comn. (Levi Joy, Secy., 51 Union St.) for $1,000,000 bonds issued for the purpose of erecting a court house.

Kountze, Tex.—Bids will be received by the Bd. Co. Comrs., until May 12 for erecting a jail; M. T. Lewman & Co., Archts., Louisville, Ky. For further information apply to H. N. Vickers, Kountze.

Corsicana, Tex.—C. L. Jester, Co. Judge, writes that the contract for erecting a court house (bids opened Apr. 15) has been awarded to the General Supply & Constr. Co., of Ft. Worth; cost reported to be about $128,900.

**Charlottesville, Va.*—The Newport News Htg. & Plumbing Co., of Newport News, has secured the contract for heating the U. S. Post-Office at Charlottesville (bids opened Apr. 24) for $2,237.

Ft. Ethan Allen, Vt.—Bids will be received by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, on May 27, for the construction, plumbing, heating and wiring for electric lighting of an administration building, additions to band barracks and constructing and plumbing lavatory addition to shops at Ft. Ethan Allen, as advertised in The Engineering Record.

Vancouver Barracks, Wash.—Bids will be received May 27 by the Constr. Q. M., U. S. A., at Vancouver Barracks, for the the construction, including plumbing, heating and electric wiring of an administration bldg., band barracks, granary, hay and wagon shed, Q. M. shop, Q. M. storehouse and bakery at Vancouver Barracks.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Mobile, Ala.*—Jett Bros., of Mobile, have secured the contract for erecting a 6-story hotel for O. F. Cawthorn for about $200,000.

Ft. Smith, Ark.—Plans have been prepared, according to reports, for a 6-story hotel which is to be erected at a cost of $200,000. W. R. Abbott and Harry E. Kelley are said to be the promoters.

Los Angeles, Cal.—The erection of a building in this city to be used as the official headquarters of the Women of Woodcraft and to cost about $50,000 is reported under consideration.

San Francisco, Cal.—See "Miscellaneous."

San Francisco, Cal.—Mrs. Mary Hickler, it is reported, is considering plans for either a 2-story or a 3-story building on N. Raymond St. to cost $40,000 or $60,000 respectively.

Denver, Colo.—The Duffy Storage & Moving Co., it is stated, has secured a site at S. 14th and W. 10th Ave. on which it is proposed erecting a 5-story warehouse at a cost of $50,000.

It is reported that the Knights of Columbus are contemplating the erection of a building to cost about $75,000. John H. Reddin is a member of the Bd. of Directors.

David May, of the May Clothing Co., it is reported, has announced that an 8-story building is to be erected at Champa and 16th Sts. for his company.

Hartford, Conn.—It is stated that the Center Church congregation has received a gift of $100,000 to erect a parish house. Rev. R. H. Potter, Pastor.

Jacksonville, Fla.—Geo. W. Clark and Harold Weston, it is stated, have purchased a site at Forsythe and Main Sts. on which it is proposed erecting an 8-story office building.

Savannah, Ga.—It is reported that improvements are to be made to the De Soto Hotel at a cost of $30,000.

Chicago, Ill.—The Commercial National Deposit Co. (Jas. H. Eckels, Pres.) has been incorporated, with a capital of $2,000,000, for the purpose of erecting the new bank building for the Commercial National Bank at Clark and Adams Sts. The building will ultimately be an 18-story structure, though only 6 stories are to be built for the present.

The 6-story mercantile building at 117-123 Market St., which was recently purchased by Alfred H. Gross, is to be entirely remodeled after plans by W. Carbys Zimmerman, 21 Van Buren St. The work will include an electric service and will cost $35,000.

Evanston, Ill.—The State Bank of Evanston has purchased the leasehold of a site at Davis St. and Orrington Ave., and will erect there a building for its own use to also contain stores and offices. Probable cost, $50,000.

Connersville, Ind.—It is reported that plans are being prepared for a theatre which it is proposed to erect here at a cost of $60,000. Jas. C. and Howard Mount are interested.

Muncie, Ind.—H. R. Wysor is reported as having plans prepared for a 6-story building 125x62½ ft. on Main and Walnut Sts.

Cambridge City, Ind.—E. A. Grubbs Grain Co. will erect an office and general ware and seed house combined, 24x130 ft.

Sullivan, Ind.—J. W. Ballantine, of Terre Haute, it is reported, has been engaged to prepare plans for the theatre which is to be erected here by H. L. Breinig, of Terre Haute, at a cost of $25,000.

**Sioux City, Ia.*—The Simmons Hardware Co., it is stated, has awarded the contract to erect its building in this city to Frank B. Gilbreth, of New York City, N. Y., at about $300,000.

Portland, Me.—The directors of the Portland Savings Bank, it is stated, intend erecting a 5-story reinforced concrete storage warehouse at Cumberland and Preble Sts.

**Baltimore, Md.*—Chas. Gilpin, of Philadelphia, Pa., it is reported, has received the contract to erect a 3-story warehouse at 22 W. Baltimore St. at a cost of about $40,000.

*Wells Bros., of N. Y. City, it is reported, have received the contract to erect the 13-story office building for the B. & O. R. R. Co., estimated to cost about $1,500,000.

The Columbia Amusement Co. of N. Y. City, it is reported, has purchased a site at Baltimore St. and Post-Office Ave., and intends erecting a theatre to cost $150,000.

Boston, Mass.—Archt. Frank A. Bourne, Room 26 Mason Bldg., would like estimates on new pile and concrete foundation under a 5-story brick building, 125x60 ft.

Minneapolis, Minn.—Kees & Colburn, 603 Kasto Blk., it is stated, are the archts. for a cafe which the Pabst Brewing Co. intends erecting at Nicollet Ave. and Washington St. at a cost of $50,000.

Boehme & Cordella, Kasora Bldg., it is stated, have prepared plans fbr a hotel which is to be erected on 5th St. by Wondersee & Moxley at a cost of $20,000. Fritz Schreyer, owner.

Jackson, Miss.—It is stated that the plans of R. H. Hunt, of Chattanooga, Tenn., have been accepted for a business building which is to be erected here at a cost of $50,000.

St. Louis, Mo.—An 8-story and basement department store, to be known as the Grand-Leader, is to be erected at Washington and Lucas Aves. and 6th St. for the Stix, Baer & Fuller Dry Goods Co., the cost of the building alone reported to be about $1,500,000. The Westlake Constr. Co., 510 Pine St. is the builder, and Mauran, Russell & Garden, 721 Olive St., the Archts.

Tuscan Lodge No. 360, it is reported, intends erecting a $30,000 lodge building. Wm. N. McConklin, Secy.

**St. Joseph, Mo.*—P. P. Buddy, 419 Main St., it is reported, has received the contract to erect the convention hall at about $125,000.

Beatrice, Neb.—It is stated that a depot is to be erected here by the Burlington R. R. (I. S. P. Weeks, Engr., Lincoln) at a cost of $70,000.

Omaha, Neb.—Hayden Bros., it is stated, have received a permit to erect a 4-story steel and concrete store building at 1616 Douglas St., at a cost of $60,000.

**Paterson, N. J.*—The Leonard Breen Bldg. Co., 45 Lowe St., it is reported has received the contract to erect a 2-story brick building for the Consumers' Baking Co. to cost $18,253.

New Brunswick, N. J.—It is stated that a building is to be erected by the Middlesex Elks at Albany and Spring Sts. to cost $20,000. J. D. Prosner is a member of the Com. having the construction of the building in charge.

Trenton, N. J.—The Mercer Bldg. Co. has been formed to erect a 10-story office building at State and Broad Sts. at a cost of $500,000. John P. Dullard and W. Meredith Dickinson, of Trenton, are among the incorporators.

Rahway, N. J.—The Common Council, it is stated, has decided to erect a new city hall.

Jersey City, N. J.—See "Railroads."

Utica, N. Y.—The Eumenia Lodge I. O. O. F., it is stated, intends erecting a 3-story brick building at Lenox Ave. and Main St. to cost $20,000.

Rochester, N. Y.—It is reported that plans have been filed for a new building for Sibley, Lindsay & Curr. Co., which is to be erected at Main St. E. and Clinton Ave. S. at a cost of $125,000.

Toledo, O.—Plans are being prepared by H. W. Wachter, "The Nasby," for a 4-story brick hotel and store building which is to be erected at St. Clair, Summit, Jackson and Orange Sts., by G. W. Close, of Berlin Heights, to cost about $125,000.

Lorain, O.—It is reported that a 4-story 70x130 ft. building is to be erected for the Lorain Savings & Trust Co. at a cost of $100,000.

Collinwood, O.—Briggs & Nelson, of Cleveland, it is reported, are the archts. for a $20,000 Y. M. C. A. bldg. which the Lake Shore & Michigan Southern Ry. (E. A. Handy, Ch. Engr., Cleveland) intends erecting here.

Cincinnati, O.—The firm of Miholwitch, Fletcher & Co., it is stated, will erect a 6-story brick and stone fireproof building on E. Pearl St. to cost about $50,000.

Plans have been approved for a building which is to be erected for Louis Stix & Co., at 7th and Walnut Sts. at a cost of about $175,000.

Lorain, O.—It is reported that the Baltimore & Ohio R. R. Co. (J. E. Greiner, Engr. of Bridges & Bldgs., Baltimore, Md.) has decided to erect a new roundhouse here at a cost of $30,000, to take the place of the building partially burned 2 months ago.

**Columbus, O.*—It is reported that Danl. W. McGrath, Ruggery Bldg., has received the contract to erect the 6-story business block for the American Savings Bank Co. at High and Town Sts. at $92,030.

**McKeesport, Pa.*—The Masonic Temple Assoc., it is stated, has awarded the contract to erect a 5-story stone and brick building at Walnut St. and 6th Ave. to McGovern & Lytle, of Pittsburg, at $111,500.

*It is stated that Breick Bros., of McKeesport, secured the contract to erect a 6-story hotel on 5th Ave. for Dr. Thos. L. White at $85,000.

Altoona, Pa.—It is stated that bids will be received until May 10 by E. A. Westover, archt., Keith Bldg., Philadelphia, Pa., for erecting a furniture store for O. Rothert to be constructed of brick, stone and steel, 5 stories high and to cost $60,000.

**Pottsville, Pa.*—Edwin Gilbert & Co., it is reported, have received the contract to erect a 4-story fireproof office building of brick, stone and terra cotta, 62x110 ft. for the Philadelphia & Reading Coal & Iron Co. It is to cost about $125,000. Forbes Smith, of Reading, is the archt.

Philadelphia, Pa.—Lloyd Titus, Pennsylvania Bldg., it is stated has prepared plans and is receiving bids for the erection of a 12-story office building for the Tradesmen's Trust Co.

**Mitchell, S. D.*—Fred. Bjidstrup, it is stated, has received the contract to erect the Commercial & Savings Bank Bldg. at about $25,000.

**Aberdeen, S. D.*—E. A. Brandes, of Aberdeen, it is reported, has received the contract to erect a building for B. C. Lamont at $16,904.

Chattanooga, Tenn.—T. S. Wilcox, Pres. of the Wilcox Plumbing Co., it is reported, has purchased a site on Georgia Ave. at a cost of $25,000 and intends erecting a theatre.

**Knoxville, Tenn.*—Anderson & Co., are stated to have secured the contract for erecting a steel frame fireproof and storage house for the Knoxville Traction Co., on Park St., for about $70,000.

Local press reports state that bids will be received until June 1 for erecting a 10-story building for the Mechanics Natl. Bank which is to cost about $200,000. E. G. Oates, Cashier of the bank, may be able to give further information. Morgan & Dillon, Atlanta, Ga., are the archts.

Memphis, Tenn.—The Bldg. Com. of the Business Men's Club, it is reported, is having plans prepared for a 12-story office and clubroom building which they propose erecting of brick and stone at a cost of about $150,000.

**Crossville, Tenn.*—M. T. Lewman & Co., of Louisville, Ky., it is stated has received the contract to erect the court house for $23,000.

**Helper, Utah.*—Archt. C. M. Neuhausen, of Salt Lake City, writes that the contract for erecting a Y. M. C. A. bldg. at Helper (bids opened Apr. 21) has been awarded to H. A. Roenish, of Salt Lake City, for $19,250.

Drakes Branch, Va.—It is stated that bids will be received until May 15 by Bank of Chase City for erecting a brick bank building. W. C. West, archt., 1103 E. Main St., Richmond.

Seattle, Wash.—John Graham, Globe Blk., it is stated, has prepared plans for the 10-story building which it is proposed erecting for the Seattle Northwestern Stock & Produce Exchange at a cost of about $400,000. Capt. H. Humphrey Read is Pres. of the Exchange.

Fairmont, W. Va.—Lon C. Smith, it is stated, has prepared plans for an 8-story building which is to be erected on Jefferson St., the 2 upper floors to be used for the Masonic Lodge. Gov. A. B. Fleming, it is reported, is the owner of the building.

Milwaukee, Wis.—Edw. Bouer, it is reported, contemplates erecting a paper warehouse at Hanover and Florida Sts., to be two stories high, of brick and stone and cost about $20,000.

*The contract to erect the 8-story general office and operating building for the Wisconsin Telephone Co. at 5th St. near Grand Ave., it is reported, has been secured by Lanquist & Ilsley, of Chicago, Ill., at about $225,000.

Menasha, Wis.—It is reported that C. R. Smith is interested in the project to erect a hotel here at a cost of $30,000.

Green Bay, Wis.—The Green Bay business men, it is stated, are backing a plan to erect a hotel to cost about $100,000.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—Carrigan & Lynn, it is stated, have received the contract to erect an apartment house for J. G. Whitfield at 5th Ave. and 23d St., to cost about $24,000. W. E. Spink, Guarantee Bldg., is the archt.

Colorado Springs, Colo.—It is reported that the members of the R. C. Church intend erecting an edifice to cost $100,000. Rev. Fredk. Bender, Pastor.

Denver, Colo.—J. E. Holmberg, it is stated, intends erecting an apartment house at Franklin and 14th Ave. to cost $25,000.

Wilmington, Del.—It is reported that the following are the bids received for erecting an edifice for the Washington Heights M. E. Church: Alfred J. Downward, $21,800; John E. Healey, $21,999; A. W. Brierley, $22,100; George S. McKee, $23,200; John B. Johnson, $23,500; Haddock & Co., $23,755; Jas. L. Hewes, $24,200.

Chicago, Ill.—E. Stanford Hall has completed plans for a new church for the Messiah Baptist congregation, to be erected at Flournoy St. and Sacramento Ave. It will be a brick and stone structure, 70x115 ft. and will cost $50,000.

Chicago, Ill.—L. Mart Mitchell, 145 La Salle St., has made plans for a 3-story apartment, 161x75 ft., which Wm. T. Woodley will build at Michigan Boule. and 56th St., at a cost of $75,000.

C. F. Johnston will build a 3-story apartment, 100x132 ft., at Kenmore and Foster Aves., after plans by C. A. Strandel, 131 La Salle St.; cost, $75,000.

Fowler, Ind.—The congregation of the French Catholic Church, it is reported, is contemplating the erection of a new edifice to cost $25,000.

**Indianapolis, Ind.*—Fred. C. Smock & Co., 211 W. Walnut St., it is reported, have received the contract to erect a residence for A. M. Sweeny at Meridian and 30th Sts., to cost about $40,000.

It is stated that bids will be received about May 25 for erecting an edifice for the Meridan M. E. Church, to cost about $135,000. D. A. Bohlen, archt.

Baltimore, Md.—Rev. H. L. Stevens, Pastor of Calvary Methodist Church, it is stated, has announced that the congregation is contemplating the erection of a new edifice at a cost of $50,000.

**Items marked thus give the names of parties awarded contracts.*

New Bedford, Mass.—It is reported that competitive plans are to be submitted for a church for St. John the Baptist Society. Rev. Mr. Neves may be able to give information.

**Freeport, Minn.*—Paul Kocholi, of St. Cloud, Minn., it is stated has received the contract to erect the basement of the R. C. Church which is to replace the structure which was destroyed by fire recently at $21,500.

St. Paul, Minn.—A permit has been issued to Benj. Goldman for 5-story brick addition to Virginia Flats on Summit Ave. and Central Park Pl. to cost $20,000.

Minneapolis, Minn.—Boehme & Cordella, Kasora Bldg., it is stated, have prepared plans for an edifice for the Russian Church which is to cost about $20,000.

Columbus, Miss.—The congregation of the Temple B'Nai Israel, it is reported, intends erecting a synagogue at a cost of $20,000.

Bayonne, N. J.—The members of the St. Joseph Slavish Catholic Church, it is stated, have purchased a site at Ave. E and E. 21st St. and intend erecting a rectory and parochial school to cost about $50,000.

**Madison, N. J.*—The members of the R. C. Church of St. Vincent, it is stated, intend erecting a new edifice on the Condon property on Green Village Road at a cost of about $100,000. Corbett & Clark have the contract for the carpenter work and John V. Corbett, of Madison, the contract for the masonry. J. O'Rourke & Sons, of Newark, are the archts.

Princeton, N. J.—Plans have been approved for an edifice which is to be erected at Nassau and Vandeventer Sts. for the M. E. Church at a cost of about $50,000. Rev. Dr. W. W. Moffett is the pastor.

Jersey City, N. J.—Rev. John L. Scudder, of the First Congregational Church, it is stated, has announced that two buildings are to be erected for the People's Palace with the $100,000 recently donated by Jos. Milbank.

Newark, N. J.—The Trus. of the Forest Hill Presbyterian Church, it is stated, have decided to accept the offer of Elias G. Heller to erect a new edifice at Highland Ave. and Heller Parkway to be known as the Heller Memorial Church, the structure to cost about $50,000, on condition that $20,000 is raised by the members of the church, to erect a Sunday school building.

New York, N. Y.—Plans have been filed for a 3-story edifice which is to be erected for the congregation of the North Presbyterian Church at 115th St. and St. Nicholas Ave. at a cost of $40,000. Ludlow & Valentine, Archts., 1 E. 27th St.

Schenectady, N. Y.—The members of the Episcopal Church, it is stated, are planning to erect a new edifice at a cost of $25,000. Address Rector.

Mt. Vernon, N. Y.—Herbert Lucas, 1133 B'way, N. Y. City, it is stated, has prepared plans for a residence which is to be erected on Summit Ave. and Clinton Pl. for Francis A. Stratton, Pres. of the Westchester Lighting Co., at a cost of $40,000.

**Ashtabula, O.*—John H. Agnew, of Lorain, it is stated, has received the contract to erect the First Methodist Church at $27,880.

Youngstown, O.—The members of the United Presbyterian Church, it is stated, have purchased a site on Delson Ave. and intend erecting an edifice at a cost of $20,000. Geo. S. Smith, of Youngstown, is a member of the Bldg. Com.

Norfolk, Va.—R. Margolius, of the firm of Margolius & Co., it is reported, has authorized plans prepared for an apartment house which is to be erected on Freemason St. at a cost of $20,000.

Spokane, Wash.—It is reported that the members of the First M. E. Church intend erecting a $50,000 edifice. Address Pastor.

Tacoma, Wash.—It is reported that the congregation of St. Patrick's R. C. Church has decided to erect an edifice at 12th and Jay Sts. to cost $25,000. Rev. Anthony LeBlanc, Pastor.

**Winnipeg, Man.*—Wm. Grace & Co., of Chicago, Ill., it is reported, have received the contract to erect a Methodist Church here to cost about $85,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—B. F. Barbour Plumbing & Electric Co., 2010 3d Ave., it is reported, has received the contract for the heating, plumbing and wiring of the High School at $20,712.

Mason, Ala.—Bids will be received May 15 by R. J. Buckner, 2305½ 2d Ave., Birmingham, for erecting the Birmingham College of the Freedman's Aid and Southern Educational Society.

Alaska.—Bids will be received by Secy. E. A. Hitchcock, Dept. of the Interior, Washington, D. C., until June 10 (readvertisement) for constructing schools in Alaska; appropriation $60,000.

San Luis Obispo, Cal.—The citizens, it is stated, have voted $30,000 to erect a high school.

Los Angeles, Cal.—Local press reports state that the Bd. Superv. will receive bids until May 15, for $780,000 public school bonds.

Washington Barracks, D. C.—The Biggs Heating Co., of Washington, it is reported, submitted the lowest bid for installing the heating apparatus in the War College (bids opened Apr. 29) at $32,000.

Athens, Ga.—The plans of H. Bleckley, Empire Bldg., Atlanta, it is stated, have been accepted by the Bldg. Com. of the Bd. Trus. for the new science and industrial hall for the State Normal School here. Cost $25,000.

Oxford, Ga.—It is reported that a gymnasium is to be erected on the campus of the Emory College to cost about $18,000.

Chicago, Ill.—Worthman & Neebe are the architects of a building to contain schoolrooms and an assembly hall to be built at Perry and Belmont Aves. for St. Luke's Evangelical Lutheran congregation. It will be 3 stories high, 86x70 ft. and will cost $35,000.

Robt. C. Spencer, 17 Van Buren St., is preparing plans for a public school building to be erected in Oak Park for the Bd. of Educ. It will be a 3-story brick and stone structure and will cost $160,000.

Wm. J. Brinkmann, 163 Randolph St., has prepared plans for a convent to be 4 stories high, of brick and stone, 35x90 ft., which is to be erected for the R. C. Visitation parish at 55th and Peoria Sts. at a cost of $25,000.

Evansville, Ind.—Bids will be received in May for rebuilding the Campbell St. School, probable cost $30,000. Archt. Frank J. Schlotter, of Evansville. Miss L. M. Butler, Clk. School Bd.

Bloomington, Ind.—It is reported that competitive plans will be received by W. H. Smith, Clk. Bd. Trus., of Indiana Univ., for the new law school and library building.

**Indianapolis, Ind.*—John E. Cleland, Bus. Dir. Bd. of Educ., writes that the contract for a ventilating and heating apparatus in school on Rural and Washington Sts. (bids opened Apr. 25) has been awarded to Keller & McCarthy, of Indianapolis, for $4,985.

Corydon, Ia.—Bids will be received May 24 by the Bd. Educ., Independent School Dist. (J. R. Stromsten, Secy.) for erecting a high school; a separate bid will be received for ventilating, heating and plumbing; probable cost, $15,000. W. R. Parson & Son Co., Archts., 317 E. 5th St., Des Moines, Ia.

Lexington, Ky.—Andrew Carnegie, it is stated, has given $25,000 to Lexington Univ. to erect a science building on condition that a like sum is raised as an endowment fund.

Cheneyville, La.—The Bldg. Com. has accepted the plans of Harnold & Gauthier, for the brick high school which is to be erected at a cost of $18,000.

Baltimore, Md.—The following are reported to be the bids received recently for school improvements: Addition to School No. 99, Henry S. Rippel, $28,600; J. Schamberger, $27,960; J. A. Sheridan & Co., $30,000; C. L. Stockhausen, $26,540. School at Lakewood Ave. and Oliver St., C. L. Stockhausen, $89,000, or $2,825 off if third story is not completed; D. W. & G. H. Thomas, $107,000, or $3,000 off if third story is not completed. School at Ramsay and Pulaski Sts., C. L. Stockhausen, $82,950, or $2,825 off if third story is not completed; W. H. Hildebrandt, $91,771, or $5,200 off if third story is not completed; D. W. & G. H. Thomas, $103,000, or $3,000 off if third story is not completed.

Fall River, Mass.—It is stated that bids will be received until May 15 by Louis G. Destremps & Son, archts., 56 Main St., for erecting a 9-room school for St. Joseph parish.

Detroit, Mich.—The Bd. of Estimators, it is reported, has approved the following appropriations for erecting 4 schools: $50,000 for a 15-room building and $7,500 for a site east of Mt. Elliott and north of Gratiot, also the same amount for a 15-room building and site to relieve McKinstry School, $50,000 to erect a 15-room school to replace Hickey School and $1,500 for additional land for a site, and also $50,000 for a 15-room school in the vicinity of Gratiot and city limits and $3,920 for a site.

Springwells, Mich.—A bill has passed the House authorizing this city to issue $50,000 school bonds.

Ishpeming, Mich.—It is proposed to erect a $20,000 school. Chas. Burt, Dir. School Bd.

Sault Ste. Marie, Mich.—The School Bd., it is reported, has decided to rebuild the Algonquin School at a probable cost of $20,000.

Winona, Minn.—It is reported that a bill has passed the Legislature appropriating $35,000 for improvements to the Normal School.

Minneapolis, Minn.—The Univ. of Minnesota, it is stated, has received $400,000 for its new building.

*Wandersee & Moxley, it is reported, have received the contract to erect the superstructure of the St. Boniface parochial school at 7th Ave. N. W. and Univ. Ave. at about $22,000. Boehme & Cordella, Kasora Bldg., are the archts.

**Faribault, Minn.*—The Secy. State Bd. of Control, St. Paul, writes that the contract for erecting buildings at the Feeble Minded School at Faribault (bids opened Apr. 17) has been awarded to W. S. Kingsley, of Faribault; cost reported to be about $35,000.

Laurel, Miss.—The Mayor and the Bd. of Aldermen, it is reported, are considering plans for a 3-story brick and stone school which it is proposed erecting at a cost of $25,000.

Columbia, Miss.—The plans of R. H. Hunt, of Chattanooga, Tenn., it is stated, have been accepted for a school which is to be erected at a cost of $30,000.

Winona, Miss.—The Bd. of Trus. of the Central Mississippi Presbytery, it is stated, intend erecting a college here to cost about $30,000. Rev. A. F. Laird is a member of the Bd. of Trus.

Kirksville, Mo.—The Bd. of Regents, it is stated, has engaged an archt. to prepare plans for a $50,000 building to be erected on the campus.

Cape Girardeau, Mo.—Bids will be received May 23 by J. B. Legg, archt., 715 Locust St., St. Louis, for direct and indirect heating about 1,500,000 ft. in Academic Hall and Manual Training Bldg., lighting same and installing vacuum system and heat regulation in Science and Practice Halls of State Normal School, 3d Dist., Cape Girardeau.

Missoula, Mont.—It is reported that a library is to be erected at the Univ. of Montana to cost about $30,000.

Emerson, Neb.—Eisentraut-Colby-Pottinger Co., of Sioux City, Ia., it is stated, are preparing plans for a 2-story and basement 8-room school to cost $20,000.

Orange, N. J.—The Central School which the Bd. of Educ. intends erecting at Main and Cleveland Sts. is to cost about $95,000.

Newark, N. J.—The Com. on Schoolhouses of the Bd. of Educ., it is reported, has accepted the plans of Hurd & Sutton for the new Belmont Ave. School; Frank E. Ward, for the new 14th Ave. School, and Chas. P. Baldwin, for the Elliott St. School.

**Harrison, N. J.*—It is reported that contracts have been awarded by the Bd. of Educ. as follows: For erecting a school on Cross St.: Mason work, Wm. H. Connolly, $17,800; carpenter, Patrick McGlennon, $13,750; plumbing, John T. Lynch, $1,725; heating, John H. Cooney, $4,274; electrical work, Wm. Browe, Son & Co., $427.

Paterson, N. J.—It is reported that $275,000 high school bonds have been sold.

Nutley, N. J.—It is reported that the Bd. of Educ. has decided to erect an addition to the Park School at a probable cost of $50,000.

New York, N. Y.—The Bd. of Trus. of Columbia Univ., it is reported, has announced that $500,000 has been given to the Univ. for the purpose of erecting a building on South Field at Amsterdam Ave. and 116th St., to be known as Hamilton Hall.

Bids will be received May 15 by C. B. J. Snyder, Supt. School Bldgs., for erecting outside iron stairs at School No. 36; also for the sanitary work and gasfitting at School No. 85; bids will also be received for installing ventilating and heating apparatus in School No. 85, all in Boro. Manhattan.

*The following are the bids opened on Apr. 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction of new Public School 3, Boro of Manhattan: Richard E. Heningham, $244,975; Guidone & Galardi, 114 E. 23d St., $231,500 (awarded contract); Thos. Cockerill & Son, $258,900; P. J. Brennan, $243,000; Chas. H. Peckworth, $237,770; P. J. Walsh, $240,000; Patk. Sullivan, $256,000, and Geo. Hildebrand, $246,284.

**Brooklyn, N. Y.*—Contracts for iron stairways, alterations, repairs, etc., on schools in Brooklyn Boro. (bids opened May 1) have been awarded as follows: To Lawrence J. Rice, 398 B'way, N. Y. City, for School No. 13 for $12,400; to Concord Constr. Co., for Schools Nos. 30 and 32 for $24,424, and to Wm. Werner, 894 Forest Ave., N. Y. City, for School No. 39 at $8,974.

Father Donahue, rector of the Pro-Cathedral, it is reported, has ordered plans prepared for an academy which is to be erected on Jay St. at a cost of $125,000.

Bids will be received by C. B. J. Snyder. Supt. School Bldgs., N. Y. City, until May 15 for general construction, etc., of School No. 92; also for new iron stairways, alterations, repairs, etc., to Schools Nos. 15 and 54 and Girls' High School, all in Boro. Brooklyn.

*Contracts for iron stairways, alterations, repairs, etc., to schools in Brooklyn Boro., bids opened by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, Apr. 24, have been awarded as follows: To John Thatcher & Son, 54 Park Ave., for Schools Nos. 18, 24, 25, 33 and 36 for a total of $46,353, and to John Ohlhausen, 257 Stockholm St., for School No. 45 for $11,587.

The following are the bids opened on Apr. 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus in Commercial High School, Boro. Brooklyn: Geo. A. Suter, $48,676; Frank Dobson, $51,843; Blake & Williams, 210 W. 20th St., N. Y. City (awarded contract), $44,693; Jas. Curran Mfg. Co., $51,629; E. Rutzler Co., $51,456; United Htg. Co., $53,900; Wm. N. Tobin, $51,182; Evans, Almirall & Co., $50,990; Dowdeswell Bros., $54,157; Rossman & Bracken Co., $47,797, and Walker & Chambers, $49,880.

New Brighton, S. I., N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, until May 15, for the general construction, etc., of School No. 7, Boro. Richmond.

Poughkeepsie, N. Y.—The Marist Brothers, who have a school near this city, are considering the erection of an addition to the buildings at a cost of $350,000.

Hertford, N. C.—Bids are wanted May 15 for $15,000 graded school dist. bonds. Address Chas. Whedbee, Secy.

Barnesville, O.—Wilbur T. Mills, of Columbus, it is reported, has completed plans for a $35,000 school.

Marion, O.—It is reported that $35,000 has been subscribed for a parochial school to be erected for St. Mary's parish. Rev. J. N. Denning, Pastor.

**Youngstown, O.*—Louis Adavasio has been awarded the contract for the erection of the Immaculate Conception Parochial school at $47,948 exclusive of excavations, electric wiring, plumbing and heating.

Tonkawa, Okla. Ter.—The Bd. of Regents of the Tonkawa Univ. preparatory school, it is stated, has accepted plans for a $50,000 addition and $10,000 for a heating plant.

Cincinnati, O.—Plans have been submitted to the Bldg. Inspector for a 3-story brick school which is to be erected at Hartford and Cleveland Aves. and to be known as the Univ. School.

**Carthagena, O.*—De Curtins Bros., 710 E. Kibby St., Lima, have secured the contract for erecting the seminary here for about $50,000.

East Palestine, O.—It is reported that the issue of $19,000 school bonds has been authorized.

Cleveland, O.—The East End School Assoc., it is reported, has accepted the plans of Hubbell & Benes, Citizens' Bldg., for the girls' private school which they intend erecting at Euclid and Logan Aves. at a probable cost of $70,000.

The Bd. of Educ., it is stated, is considering the erection of an annex to the East High School to cost approximately $15,000.

A parochial school is to be erected for the parish of Our Lady of Lourdes which is to cost $50,000. Rev. S. Furdek, Pastor.

Allegheny, Pa.—The 12th Ward School Bd. has adopted the plans of W. E. Snaman, Empire Bldg., Pittsburg, for the 12th Ward school which is to be erected at a cost of $45,000.

Plans for an addition to the East St. School which is to cost $35,000 have also been approved by the above School Bd.

Austin, Pa.—It is stated that bids are wanted until May 22 by the School Bd. for erecting an 8-room school. G. M. Rees, archt., Coudersport, Pa.

Philadelphia, Pa.—It is stated that plans have been prepared for an addition to the St. Vincent's Seminary which is to cost about $30,000.

Pittsburg, Pa.—A building permit has been granted to the parish of St. Peter and Paul's Church to erect a 2-story brick school on Flavel St. at a cost of $55,000.

It is stated that plans are being prepared for the lighting and heating plants for the Carnegie Technical School. Address Bd. of Directors.

**Items marked thus give the names of parties awarded contracts.*

The 11th Ward School Bd., it is stated, has purchased a site on Miller St. and has authorized the issue of $115,000 bonds for the erection of a school. John B. Elliott has been engaged to prepare plans for the building which is to be a 2-story brick structure and contain 18 rooms and cost about $100,000.

Nashville, Tenn.—It is reported that it is the intention to replace the burned structure at the Vanderbilt Univ. with a building to cost about $100,000.

Knoxville, Tenn.—Andrew Carnegie has given $40,000 to the Univ. of Tennessee for the erection of a library on condition that a like sum is raised as an endowment fund.

McKinney, Tex.—It is reported that the erection of a Baptist College here to cost about $25,000 is under consideration.

Lehi, Utah.—The citizens are reported to have voted to issue $18,000 bonds for a high school. Plans are being prepared.

Richmond, Va.—The plans prepared by Chas. K. Bryant, of Richmond, have been accepted for the high school which is to be of brick and stone, and is to cost, including grounds, about $300,000.

Saltville, Va.—Bids are wanted May 17 for erecting a public school here. For particulars address J. S. Goetchius, Secy. Bldg. Com.

Fairmont, W. Va.—It is reported that the citizens have voted in favor of issuing $150,000 school bonds. Four schools are to be erected at once.

**McMechen, W. Va.*—Elliott & Winchell, of Clarksburg, W. Va., it is reported, have received the contract to erect the school here at $32,398 (bids opened Apr. 26). The other bidders were: W. H. Batson, Moundsville, $33,430; A. Burkhart, New Martinsville, $26,656; Taylor Bros., Sharon, Pa., $34,283; R. L. Brown, Parkersburg, $38,524; Castoe & Warner, Bellaire, $35,429; Caldwell & Drake, $39,100.89; George Kratt, Lorain, O., $37,550; Dickinson, Bargely & Foreman, Marietta, $34,618.

Seneca, Wis.—It is reported that bids are wanted until May 9 for erecting a high school; John Fitzgibbon, Clk. School Bd. Reily Bros., Archts., Spring Green, Wis.

Rice Lake, Wis.—Van Ryn & De Gellecke, 211 Grand Ave., Milwaukee, it is stated, are preparing plans for a brick and stone school to be erected here at a cost of $35,000.

Ashland, Wis.—It is reported that bids are wanted May 22 for erecting a high school; separate bids to be received for ventilating and heating. John F. Scott, Pres., Bd. Educ.

Winnipeg, Man.—It is stated that bids are wanted until May 9 for erecting a 16-room school. Stewart Mulvey, Secy., Pub. School Bd.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Chicago, Ill.—Mayor Dunne is reported to have suggested that garbage crematories be constructed on the North and South sides of the city, with the Bridewell reduction plant to serve for the West Side, and municipal cars to transport refuse to these crematories.

**Butler, Pa.*—The Morse Boulger Destructor Co., 39 Cortlandt St., New York, N. Y., is reported to have secured the contract for constructing a garbage furnace here for $5,800.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Sitley & Son, Camden, N. J., whose plant was recently burned, will erect an elevator which will probably be 5 stories, 125x100 ft. and have a capacity of about 100,000 bu. The capacity of the power plant has not yet been decided. It is also expected to build a warehouse about 400x125 ft. in size.

F. M. Wasson, Nixa, Mo., is endeavoring to form a stock company with a capital of $10,000 to erect a 60-bbl. flour mill and an elevator of about 25,000 bu. capacity.

The Alden Sampson Mfg. Co., Pittsfield, Mass., will erect a plant for the manufacture of high-grade automobiles. The buildings will include a main building, 75x125 ft., of steel and concrete, a building for office and drafting room, one for the storage of automobiles and testing motors, and a power building, which will be equipped with water wheels and generators for supplying current to small motors throughout the plant. Work on the plant will begin at once under the supervision of Chas. K. Stearns, 93 Federal St., Boston.

The American Solidified Wood Co. is moving its plant to Alexandria, Ind., where it has bought the plant of the Kelly Axe Works, which will be rebuilt.

Peacock's Iron Works, Selma, Ala., are seeking a new location for their plant. The plans contemplate the erection of a car-wheel foundry, soft foundry, carpenter shop, machine shop, blacksmith shop, engine and boiler room, erecting shop, pattern shop, office, supply and material building, which, it is calculated, will require 15 to 25 acres.

The Industrial Lumber Co., Beaumont, Tex., contemplates making some increase in its output, although not in the immediate future.

Lee F. Mott, Cedar Rapids, Iowa, will erect a 2-story, 150x30-ft. piano stool factory. Steam power will be used and an engine of about 20 hp. and a boiler of about 30 hp., preferably second-hand, will be installed, also automatic wood lathe, two hand lathes, band saw, double shaper, boring machine, saw, planer, etc.

The Toledo-Massillon Bridge Co., Toledo, O., successor to the Massillon Bridge Co., expects to build a new plant in Toledo in the near future, but details have not yet been decided.

The Yazoo Cooperage Co., Greenwood, Miss., contemplates the erection of a heading plant to replace that recently burned. There will be a 35x45-ft. building for the sawing department and a 25x35-ft. building for the finishing plant. A battery of two 75-hp. boilers and a 100-hp. engine will be installed and a rotary machine for sawing and heading having a capacity of 25,000. There will also be the necessary dry houses, etc.

The Dixon Springs, Tenn., Mill & Grain Co. has let contract for a 75-bbl. roller mill with corn mill attached and will want a 50-hp. left-hand automatic engine, for direct gearing, with boiler to correspond.

The Crown Cork & Seal Co., Baltimore, Md., will erect a new plant which will include a 50x150-ft. factory building, a 40x150-ft. storage warehouse and a power house 60 ft. square. The equipment will include about 150 hp. in engines and generators and a boiler plant of 250 hp. in duplicate.

W. C. Burns, a student at the technical school at Atlanta, Ga., writes that it is proposed to erect a $100,000 mill, containing 5,000 spindles, at Maysville, Ga., but that nothing will be done regarding it until July 1.

H. C. Adler, of the Tennessee Fibre Co., Chattanooga, Tenn., writes that the company is not yet prepared to give out any statement regarding the plant it proposes installing.

Permit has been given to J. Bjornstad, St. Paul, Minn., for a 72x200-brick factory building on Arundel St., between Capitol and Minnehaha Sts., to cost $14,000.

M. J. Haney, Toronto, Ont., has made a proposal to establish a plant for steel building construction in Toronto, Ont., on 20 acres of marsh land, which are to be filled in, according to local newspaper reports.

The Midgley Mfg. Co., Columbus, O., has bought 6 acres of land and will erect a factory building which, with the machinery, will cost about $150,000, according to local newspaper reports.

Wm. Hjorth & Son, Jamestown, N. Y., will erect a new wrench factory, according to local newspaper reports.

The California Incubator Co., Petaluma, Cal., will erect a new factory, according to local newspaper reports.

The Falk Mfg. Co., Milwaukee, Wis., will make additions to its plant at the foot of 31st St., which will represent an outlay of about $250,000, according to local newspaper reports.

J. C. Llewellyn has let contracts for a new factory building to be erected at West Superior and Green Sts. for P. J. Kittrege, according to local newspaper reports. It is stated that the building will be 4 stories, 90x100 ft. and cost $45,000.

Mihalovitch, Fletcher & Co., Cincinnati, O., will erect a 6-story factory building in East Pearl St., between Lawrence and Pike Sts., at a cost of $50,000, according to local newspaper reports.

The Falkenau Construction Co. has been awarded the contract for building the new plant of the Troy Laundry Machinery Co., at La Salle and 23d Sts., Chicago, according to local newspaper reports. It is stated that the building will be 5 stories, 112x264 ft. and cost $200,000.

The American Malting Co., Chicago, Ill., will build a new malt house on Goose Island, for which J. F. Dornfeld has prepared plans, according to local newspaper reports. The building will be 5 stories, 50x100 ft., and the estimated cost is $50,000.

The Western Packing Co., Denver, Colo., will erect a 5-story building 175 ft. square for the purpose of engaging in the canned-meat business, according to local newspaper reports. It is stated that the cost will be $150,000.

A correspondent writes that a 3-story, 36x140-ft. brick factory building, to cost $20,000, will be erected by P. E. Somers, Worcester, Mass. E. P. Fitzgerald, archt.

The Western Packing & Provision Co., Chicago, Ill., is to erect a $200,000 slaughter house and packing plant at Morgan and 39th Sts., according to local newspaper reports. Plans for the buildings are stated to be in the hands of the architect, Z. T. Davis.

The Cownie Glove Co., Des Moines, Ia., will build an addition to its plant to cost $20,000, according to local press reports.

Geo. B. Breon, Williamsport, Pa., is in the market for woodworking machinery, pulleys, shafting and belting for use in rebuilding factory recently burned.

John T. DeBeel, A. H. Rogers and R. H. Oliver propose forming a company entitled La Compania Manufacturera de Cemento Portland Monterey, S. A. (The Monterey Portland Cement Mfg. Co., Ltd.), with a capital of $400,000 Mexican currency, for the erection of a mill in Monterey, N. L., Mexico.

The Twin City Rapid Transit Co., Minneapolis, Minn., contemplates erecting the following shop buildings during the present season: 120x520-ft. car house; 150x200-ft. machine shop, 2 stories; 100x200-ft. storehouse, 2 stories; 50x200-ft. wheel, axle and gear shop; 50x200-ft. smith and bolt shop, 60x200-ft. foundry, 60x200-ft. track special work bldg., 126x300-ft. paint shop, 75x200-ft. mill, 40x50-ft. dry kiln, 50x75-ft. office bldg., 2 stories, and a 50x100-ft. power house. All the buildings are to be of reinforced concrete construction. Willard J. Hield, gen. mgr.

The Mineral Ridge, O., Mfg. Co. is preparing to enlarge its works and expects to erect an 80x160-ft. brick and steel building. A 150-hp. boiler, 100-hp. engine and a 75 to 85 kw. generator will be required, and the shop will be equipped with a line of machine tools to handle medium-size engines to be used in connection with hoisting machinery.

Jenney & Mundie, Chicago, Ill., are preparing plans for a brick and steel building, 100 ft. square, to be erected at Cass and Indiana Sts. for the Price Baking Powder Co. at a cost of $115,000, according to local newspaper reports.

The Dilts Machine Works, Fulton, N. Y., will erect a 48x108-ft. erecting room of concrete, which will be equipped with a traveling crane running its length.

The Chicago & Southern Traction Co., Chicago, has secured a tract of land in Riverdale, where a power house, car barn, repair shop, sub-station and equipment building will be erected, according to local newspaper reports. Estimated cost, $100,000. John Youngberg, archt.

Plans are being prepared by Howard Shaw for an 8-story, 75x175-ft. and a 2-story, 26x200-ft. building for the mail-order house of Albaugh Bros., Dover & Co., at 21st St. and Marshall Boule., Chicago, according to local newspaper reports. The cost of these buildings is stated to be $125,000, and when they are completed, work will be started on other structures.

J. S. Flizikowski has prepared plans for a 3-story factory building, 100 ft. square, to be erected at 41st Court, near Cortlandt St., Chicago, for the Ferring Co., according to local newspaper reports. Cost, $25,000.

The Farr Alpaca Co., Holyoke, Mass., has let contract to Casper Ranger for the construction of a 4-story brick addition to the No. 3 mill, according to local newspaper reports. The building will be 60x300 ft., of which 60x225 ft. will be the addition to the mill and the remainder will be occupied as a power house, which will be equipped with boilers of about 250 hp. capacity, and the power will be developed from a steam turbine of 1,000 hp., directly connected to generators.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received by Maj. W. E. Craighill, Corps Engrs., U. S. A., on May 31 for dredging in Pascagoula River and Mississippi Sound, as advertised in The Engineering Record.

San Francisco, Cal.—Bids will be received May 18 by Col. Thos. H. Handbury, Corps Engrs., U. S. A., San Francisco, for rebuilding wharf, repairing its approaches and building a boat house at Humboldt (old) light station, Humboldt Bay, Cal.

Milford, Conn.—Bids will be received by Lieut. Col. C. F. Powell, Corps Engrs., U. S. A., New London, on May 20 for dredging about 55,000 cu. yd. at Milford Harbor, as advertised in The Engineering Record.

**Hartford, Conn.*—F. B. & W. H. O'Neil are stated to have secured the contract for the construction of the Park River retaining wall about 400 ft. (bids opened Apr. 26) for $5,192.

Washington, D. C.—Bids will be received May 16 by the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the Navy Yard, Washington, D. C., and the Naval Academy, Annapolis, Md., a quantity of supplies as follows: Portland cement; broken stone; paving blocks; wire, lathing; pig lead; bar iron; cesspools; soil pipe and fittings; terra cotta pipe; rivets; taps; drills; forgings, plates; angles; etc. H. T. B. Harris, Paymaster-Gen., U. S. Navy.

Augusta, Ga.—Bids will be received until June 8 by Lieut. Col. Jas. B. Quinn, Corps. Engrs., U. S. A., Savannah, for building, training and shore protection dikes in Savannah River, near Augusta, as advertised in The Engineering Record.

Augusta, Ga.—This city has commenced grading for a park bet. May Ave., 15th St. and Augusta Canal, about 30 acres. There will be approximately 50,000 cu. yds. of earth to remove; after grading is completed the grounds will be laid out for park. Nisbet Winfield, City Engr., is in charge.

Chicago, Ill.—Bids will be received May 9 by the Dept. Pub. Wks. (Wm. L. O'Connell, Deputy Comr.) for furnishing material and constructing a dock for the Chicago Ave. pipe yard, including the removal of the old dock.

East St. Louis, Ill.—At a meeting of the East Side Levee Assoc., at St. Louis, Mo., on Apr. 27, an executive committee of 7 was elected to take charge of the expenditure of $25,000 raised by the association for preliminary surveys for the East Side Levee project. The levee, as at present designed, will extend from Alton to a point about 2 miles south of East St. Louis; the distance will be about 30 miles. H. D. Sexton, Pres. Southern Illinois National Bank, of East St. Louis, is on the committee.

Havana, Ill.—M. B. Dunbar, Drainage Comr., Green Valley, Ill., writes that the J. E. Rogers Co., of Tuscola, has secured the contract for cleaning out old ditch, about 56,000 cu. yds., at 13 cts. per cu. yd. Bids were received on Apr. 21 for excavating about 206,000 cu. yds. dirt by dredge boat from ditches of Mason and Tazewell Special Drainage Dist. and all bids for the remaining portion of the work (except the 56,000 cu. yds. awarded) were rejected as being two high. New bids will probably be opened May 19.

Onawa, Ia.—Press reports state that bids will be received until June 8, by the joint Bd. Superv. of Harrison and Monona Cos., at Monoa, for the construction of Monona-Harrison drainage canal; estimated cost, $300,000.

Plaquemine, La.—Bids will be received by Lieut. Col. Clinton B. Sears, Corps Engrs., U. S. A., New Orleans, on May 29 for excavation and fill and constructing approaches of Plaquemine Lock, as advertised in The Engineering Record.

New Orleans, La.—The following are the bids opened on Apr. 25 by the Sewerage and Water Bd. for Contract "33D," London Ave. outfall: (*a*) 55,000 cu. yds. excav., (*b*) 5,000 cu. yds. rehandling of excav. material, (*c*) total: Jahncke Navigation & Improv. Co., New Orleans, *a* 12 cts., *b* 25 cts., *c* $7.850; W. J. Keegan, New Orleans, *a* 12½ cts., *b* 23 cts., *c* $8,025; St. Mary Dredging & Improvt. Co., Berwick, La., *a* 18½ cts., *b* 25 cts., *c* $11,425; Gulf Dredging & Timber Co., Donaldsville, *a* 25 cts., b 17½ cts., *c* $14,625; John McCoy, New Orleans, *a* 26½ cts., *b* 53 cts., *c* $17,225.

Portland, Me.—Bids will be received by Maj. W. M. Black, Corps Engrs., U. S. A., on May 29 for dredging in Damariscotta River, New Harbor and Bagduce River, Me., as advertised in The Engineering Record.

The following are the bids opened on May 1 at the U. S. Engr. office for Portland cement at (1) Cow Island, 5,000 bbl., (2) Ft. McKinley, 300 bbl., (3) Ft. Levett, 250 bbl., (4) Ft. Preble, 3,100 bbl., (5) Kennebec, 4,500 bbl. (*a*) in bbl., (*b*) in sacks. (Price given per bbl.): Waldo Bros. (Atlas brand), (*a*-1, 2, 3, 4, and 5), $1.79, (*b*-1, 2, 3, 4, 5), $1.42; Atlantic Cement Co. (Atlantic brand) (*a*-1, 2, 3, 4, 5) $1.62, (*a*-5) $1.66, (*b*-1, 2, 3, 4) $1.41, (*b*-5) $1.45; Alpha Portland Cement Co. (Alpha brand) (*a*-1, 4) $1.65, (*a*-2, 3) $1.67, (*a*-5) $1.68, (*b*-1, 4) $1.35, (*b*-2, 3) $1.37, (*b*-5) $1.38; Berry & Ferguson (Saylors brand) (*a*-1, 4) $1.70, (*a*-2) $1.73, (*a*-3, 5) $1.74 (*b*-1, 4) $1.41, (*b*-2) $1.44 (*b*-3, 5) $1.45; Winslow Co. (Vulcanite brand) (*a*-1, 2, 3, 4) $1.85, (*a*-5) $1.92, (*b*-1, 2, 3, 4) $1.93, (*b*-5) $2.

Baltimore, Md.—Bids will be received by the Bd. of Awards on May 24 for the construction of a stone and timber bulkhead to inclose and form Pier No. 4, as advertised in The Engineering Record.

**Items marked thus give the names of parties awarded contracts.*

Baltimore, Md.—See "Sewerage and Sewage Disposal."

Boston, Mass.—Bids will be received by Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, May 29, for excavation, etc., at Lovells Island, Mass., as advertised in The Engineering Record.

The Legislative Com. on Harbors and Public Lands is stated to have voted to report a bill incorporating the Massachusetts Ship Canal Co., with a capital of $6,000,000. The company proposes constructing and operating a ship canal across Cape Cod along what is know as the Bass River route through Dennis and Yarmouth.

Watertown, Mass.—Bids are wanted May 17 for furnishing supplies, including iron, steel, etc., during year ending June 30, 1906, for the Watertown Arsenal; address Maj. Ira MacNutt, Comdg., Ord. Dept.

Grand Rapids, Mich.—Bids will be received by Col. M. B. Adams, Corps Engrs., U. S. A., June 2 for excavating new channel from Kalamazoo River to Lake Michigan, as advertised in The Engineering Record.

Glendive, Mont.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Glendive, on June 1, for installing in connection in the Ft. Buford reclamation project, a telephone system, including 70 miles of pole line, as advertised in The Engineering Record.

Trenton, N. J.—Bids will be received May 16 by the Common Council, for constructing a concrete retaining wall at the permanent outfall of the Trenton sewer system at the southerly end of Lamberton St. and for repairing the stone wall now built at said point. Harry B. Salter, City Clk.

Asbury Park, N. J.—The citizens are reported to have voted Apr. 24 to issue $100,000 beach improvement bonds to extend boardwalk to Deal Lake and to put in additional jetties.

New York, N. Y.—Bids will be received May 15 by C. B. J. Snyder, Supt. School Bldgs., for erecting a stone retaining wall at School No. 8 Boro Bronx.

Bids will be received May 15 by the Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing materials and building a new pier near the foot of Jones Lane, East River, to be known as Pier No. 11; also for furnishing and delivering about 10,000 bbls. Portland cement.

Brooklyn, N. Y.—Bids will be received May 10 by Nicholas J. Hayes, Fire Comr., N. Y. City, for furnishing material for placing conduits for the fire dept., telegraph and alarm system underground in the Boro Brooklyn.

Buffalo, N. Y.—Bids will be received by Lieut. Col. H. M. Adams, Corps Engrs., U. S. A., May 29, for the construction of stone superstructure and sea slope and for stone riprap on South Harbor section of Buffalo breakwater, as advertised in The Engineering Record.

Troy, N. Y.—See "Water."

Ft. H. G. Wright, N. Y.—See "Public Buildings."

Columbus, O.—See " Power Plants, Gas and Electricity."

Cleveland, O.—Bids will be received by the Bd. Pub. Service (A. R. Callow, Secy.) until May 11 for furnishing materials and constructing retaining walls along Big Creek for Brookside Park; also on May 16 for grading, draining and otherwise improving a portion of Brookside Park.

Bids will be received by Bd. of Pub. Service (A. R. Callow, Secy.) until May 16, for building retaining walls along a portion of Doan Brook; also grading, draining and otherwise improving a portion of Rockefeller Park.

Cincinnati, O.—Bids will be received by Lieut. Col. E. H. Ruffner, Corps Engrs., U. S. A., Cincinnati, until May 31, for building dikes in the Ohio River at the following locations: Dike and shore protection near head of Grand Chain; dikes and shore protection with repairs to existing dikes near Mound City, Ill.

Marion, O.—Bids will be received by the County Comrs. (H. H. Noyes, Co. Surv.) May 11, for furnishing material and constructing and completing a change in the outlet of the Silver St. ditch in Marion Township, as advertised in The Engineering Record.

Panama.—Bids will be received by Maj. H. J. Gallagher, U. S. A., Purchasing Agent, Isthmian Canal Comn., Washington, D. C., until May 9, for furnishing 4,000 freight brasses and spiral riveted double galvanized pipe and extra points, and 1 doz. standard flanges.

Pittsburg, Pa.—The following are the bids opened on Apr. 19 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., for building 98 ft. of chanoine dam, 2 bear-trap dam foundations, ea. 93 ft. long, 3 chanoine weir, 160 ft. long, 3 piers and abutment, dam No. 4, Ohio River, near Legionville, Pa.: (*a*) The Dravo Contr. Co., Pittsburg; (*b*) Jas. H. McQuade Co., Pittsburg; (*c*) The Baker Contract Co., Inc., Pittsburg:

	a	*b*	*c*
25,800 cu. yds. excav.	$.80	$.85	$.80
186 M. ft. hemlock timber	55.00	60.00	55.00
67 M. ft. oak timber.	90.00	100.00	90.00
450,000 lbs. wrought iron and steel.	.075	.07	.07
143,955 lbs. cast iron.	.065	.06	.06
200 lbs. bronze.	.50	.60	.50
628 lin. ft. 4-in. galv. iron pipe.	1.25	1.00	1.00
1,112 lin. ft. 3-in. galv. iron pipe.	1.00	.50	.75
310 lin. ft. 2-in. black pipe.	.50	.25	.50
23,400 lin. ft. round piling	.70	.60	.65
212 M. ft. sheet piling	95.00	95.00	90.00
10,555 cu. yds. concrete.	8.25	8.50	8.00
4,000 cu. yds. stone crib fill.	4.00	3.50	3.00
1,757 cu. yds. large stone	4.00	3.50	3.00
6,000 cu. yds. common fill.	.65	.75	.60
180 sq. yds. paving vitr. brick.	2.00	3.00	3.00
300 cu. yds. riprap stone bank covering.	3.50	3.50	3.00
87 M. ft. crib decking	60.00	60.00	60.00
Total.	$239,345	$236,699	$224,044

**San Francisco, Cal.*—Capt. Wm. W. Harts, Corps Engr., U. S. A., writes that the following are the bids opened on Apr. 10 by the California Debris Comn. for building portion of dam known as Barrier No. 1 Yuba River, Cal.: (*a*) Lewis Moreing, Stockton, (*b*) City Street Improv. Co., San Francisco, (*c*) Palmer & McBryde, San Francisco (recommended for award), (*d*) Edw. Malley, San Francisco, (*e*) Dundon Bridge & Constr. Co., San Francisco, (*f*) D. E. Brown, San Francisco, (*g*) Cotton Bros. & Co., Oakland, (*h*) E. B. & A. L. Stone Co., Oakland:

	Large rock, 2,200 tons.	Concrete, 3,300 cu. yds.	Cable, 17,000 lin. ft.	Excav. material, 3,000 cu. yds.	Embkmt, 12,000 cu. yds.	Bulkhead lumber, 59 M. ft.	Rock fill, 10,000 tons.	Brush mattress, 800 sq. yds.	Bags filled with sand, 5,000 ea.	Total.
a	$2.00	$6.00	$.18	$1.00	$.60	$60.00	$1.50	$.65	$.15	$57,270
b	1.95	3.10	.1375	.30	.45	36.00	1.33⅓	.65	.05	39,885
c	2.00	4.25	.15	.75	.30	25.00	.875	.70	.07	37,060
d	1.50	4.00	.15	.40	.40	45.00	1.00	.40	.10	38,525
e	2.40	4.00	.15	.70	.40	48.00	1.70	.80	.50	50,902
f	2.75	4.50	.15	.40	.60	55.00	1.20	.50	.15	45,865
g	1.46	4.62	.19	.43	.44	40.00	1.06	.87	.20	42,914
h	1.50	6.50	.20	.40	.30	40.00	1.50	1.00	.12	51,710

New Orleans, La.—The following are the bids opened on Apr. 25 by the Sewerage and Water Bd. for the Orleans Relief and the Melpomene St. Canals: (*a*) Dunn Philbrick & Co., Hibernia Bank Bldg., (*b*) Chas. R. Corbett, 224 Vallette St., (c) W. O. Burton, Tchoupitoulis and Julia Sts.

Contract "31-D," Orleans Relief Canal.

	a	*b*	*c*
80,000 cu. yds. excav., delivered	$.49	$.50	$.65
40,000 cu. yds. overhaul per 100 ft.	.02½	.20	.25
6,000 cu. yds. rehandling of excav. material	.25	.30	.25
81,000 lin. ft. 12-in. round yellow pine piling	.30	.30	.30
Pine, etc., including iron fastenings:			
345 M. ft. yellow pine or cypress capping	35.00	27.00	45.00
410 M. dressed cypress plank	30.00	27.00	25.00
490 M. ft. creosoted pine lumber, dressed	43.50	40.00	45.00
113 M. ft. yellow pine lumber in bridges	32.00	30.00	30.00
64 M. ft. cypress lumber in culverts	32.50	27.00	25.00
260 cu. yds. concrete	10.00	20.00	10.00
14,000 lbs. steel rods	.05	.05	.04
9,000 lbs. cast iron	.05	.04	.03
5,000 lin. ft. 3-in. porous drain tiles	.10	.10	.04
10,000 lin. ft. creosoted 12-in. round yellow pine piling	.42½	.50	.45
Total	$122,686	$127,963	$145,745

Contract "32-D," Melpomene St. Canal.

	a	*c*
65.000 cu. yds. excav. delivered	$.49	$.60
60,000 cu. yds. overhaul per 100 ft.	.02½	.08
1,000 cu. yd. rehandling of excav. material	.25	.15
42,000 lin. ft. 12-in. round yellow pine piling	.30	.25
Pine, etc., including iron fastenings:		
200 M. ft. yellow pine or cypress capping	35.00	45.00
235 M. ft. dressed cypress planking	30.00	25.00
285 M. creosoted pine lumber, dressed	43.50	45.00
55 M. ft. yellow pine lumber in bridges	32.00	30.00
50 M. ft. cypress lumber in culverts	32.50	25.00
130 cu. yds. concrete	10.00	10.00
7,000 lbs. steel rods	.05	.04
6,000 lbs. cast iron	.05	.03
5,000 lin. ft. 3-in. porous drain tiles	.10	.04
10,000 lin. ft. creosoted 12-in. round yellow pine piling	.42½	.45
Total	$82,732	$91,510

Philadelphia, Pa.—See "Power Plants, Gas and Electricity."

**Pittsburg, Pa.*—Maj. Wm. L. Sibert, Corps. Engrs., U. S. A., writes that contracts have been awarded as follows (bids opened Apr. 17 and 18): Dam No. 2 at Six Mile Island, Allegheny River, to J. S. H. McQuade, Pittsburg, for $197,337; Dam No. 3, Ohio River at Glenosborne, Pa., to the Ohio River Contract Co., of Evansville, Ind., for $217,020, and Dam No. 5, Ohio River near Freedom, Pa., to the Dravo Contr. Co., Pittsburg, for $273,408. For list of detail bids received for this work see issue of The Engineering Record, Apr. 29.

**Philadelphia, Pa.*—Armstrong & Latta, Land Title Bldg., are stated to have received the contract from the Rapid Transit Co. for the construction of a pier on the Delaware, to take the place of Piers Nos. 33 and 34, North Wharves. It will be about 120x500 ft. and have concrete walls resting upon piles and filled in with earth between the walls; the cost will be about $80,000.

Olongapo, P. I.—Bids will be received Aug. 26 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing a plant for handling and storing coal at the naval sta., Olongapo, P. I.; appropriation, $500,000. Plans and specifications may be secured at the bureau upon a deposit of $10.

Ft. Moultrie, S. C.—Bids are wanted until May 11 for repairing a timber bulkhead here; address Capt. F. W. Cole, Q. M., U. S. A., Ft. Moultrie.

Pierre, S. D.—The following are the bids opened on Apr. 25 by the Superv. Archt., Treas. Dept., Washington, D. C., for the low pressure steam heating apparatus for the U. S. Post-Office at Pierre: Symons-Powers Co., Sioux Falls, $3,925; L. McGinness, Minneapolis, Minn., $3,889; C. H. Kees Eng'g Co., St. Paul, Minn., $3,985.

Nashville, Tenn.—Bids will be received until June 5 by Maj. H. C. Newcomer, Corps. Engrs., U. S. A., for furnishing and delivering about 453,406 M. ft. long-leaf yellow pine timber.

Galveston, Tex.—Bids will be received by Capt. Edgar Jadwin, Corps Engrs., U. S. A., May 31, for a suction dredge, as advertised in The Engineering Record.

Charlottesville, Va.—The lowest bid opened on Apr. 24 by the Superv. Archt., Treas. Dept., Washington, D. C., for a low-pressure steam heating apparatus for U. S. Post-Office at Charlottesville was submitted by the Newport Plumbing & Htg. Co., of Newport News, for $2,237.

Wheeling, W. Va.—Bids will be received May 18 by the Bd. Co. Comrs. (T. C. Moffat, Clk.) for building a stone (or concrete) retaining wall near Thompson's on the National Road. Herman L. Arbenz, Co. Engr., 1505 Chapline St.

**Arden, Man.*—M. E. Boughton, Town Secy., writes that the contract for constructing the Jumping Deer Drain (bids opened Apr. 25) has been awarded to Macdonald-McMillan Co., of Winnipeg, for $5,160.

Ottawa, Ont.—It is stated that bids will be received until May 15 by the Dept. Pub. Wks. (Fred Gelinas, Secy.) for dredging in various places.

PROPOSALS OPEN

For Proposals see pages 68, 71, 75, 76, 77, 78 and 79

WATER WORKS.

May 10.	Chamberlain, S. D.	Apr. 22
May 10.	Pipe, Dayton, O.	Apr. 29
May 10.	Meters, Dayton, O.	Apr. 29
May 10.	Wells, Havre, Mont.	May 6
May 10.	Reservoir improv., Boston, Mass. Adv. Apr. 29, May 6.	Apr. 29
May 10.	Pipe, Chicago, Ill.	May 6
May 10.	Pipe, Perth Amboy, N. J.	May 6
May 11.	Pipe, New Orleans, La.	Mar. 25
May 11.	Pipe, West Point, N. Y. Adv. Apr. 15 to May 6.	
May 11.	System, Ft. Ontario, N. Y. Adv. Apr. 15 to May 6.	Apr. 15
May 12.	Pipe, etc., Cincinnati, O.	Apr. 22
May 12.	Dam, etc., Oneida, N. Y. Adv. May 6.	May 6
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que Adv. Mar. 11.	Mar. 11
May 15.	Gates, etc., La Junta, Colo	Apr. 29
May 15.	Engine, etc., Cleveland, O.	May 6
May 15.	Standpipe, Montgomery, Ala.	May 6
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 29.	Mar. 25
May 16.	Mains, Ada, Minn.	May 6
May 16.	Pipe, etc., Cleveland, O. Adv. May 6.	May 6
May 16.	Improv., Marshall, Tex.	May 6
May 17.	Lumberton, Miss. Adv. May 6.	May 6
May 17.	Mains, Brooklyn, N. Y.	May 6
May 17.	System, New Madrid, Mo.	May 6
May 18.	Pipe, valves, etc., Ft. Assinniboine, Mont.	Apr. 29
May 18.	Water wheels, etc., Oneida, N. Y. Adv. May 6.	May 6
May 18.	Pumps, Oswego, N. Y. Adv. May 6.	May 6
May 20.	Curb, intake, etc., Oswego, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
May 20.	Pipe, etc., Chicago, Ill.	May 6
May 27.	Meters, hydrants, etc., Panama Adv. May 6.	May 6
Jun. 1.	Canal, etc., Glendive, Mont. Adv. Apr. 8 to May 6.	Apr. 8
Jun. 2.	Engines, etc., Cincinnati, O.	May 6
Jun. 5.	Irrig. work, Yuma, Ariz	May 6
Jun. 6.	Tunnel, etc., Toronto, Ont. Adv. May 6.	May 6
Jun. 8.	Franchise, Ventura, Cal.	May 6
Jun. 15.	Canal, etc., Minidoka, Idaho Adv. Apr. 22 to May 6.	Apr. 22
Jun. 15.	Dam, etc., Casper, Wyo Adv. Apr. 29, May 6.	Apr. 29
Jun. 15.	Controlling works, etc., Tahoe, Cal. Adv. May 6.	May 6
Jun. 28.	Irrig. work, Billings, Mont. Adv. May 6.	May 6
Jun. 28.	Pump sta., etc., Huntley, Mont. Adv. May 6.	May 6
Jun. —.	Prescott, Wash.	Apr. 1
Jun. —.	Alma, Wash.	Apr. 22

**Items marked thus give the names of parties awarded contracts.*

Jun. —.	Pumps, etc., Richland, Ga.	Apr. 22
Jun. —.	Pipe, etc., Thibodaux, La.	Apr. 22
———	Granbury, Tex.	Apr. 29

SEWERAGE AND SEWAGE DISPOSAL.

May 9.	Wellsville, N. Y. Adv. Apr. 22.	Apr. 22
May 9.	Tipton, Ind.	Apr. 29
May 9.	Fremont, O.	Apr. 29
May 9.	Youngstown, O.	Apr. 29
May 9.	Findaly, O.	May 6
May 9.	Wilmington, Del.	May 6
May 10.	Chamberlain, S. D.	Apr. 22
May 11.	Brooklyn, N. Y.	May 6
May 12.	Idaho Falls, Idaho. Adv. Apr. 22 to May 6	Apr. 22
May 12.	Lestershire, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
May 12.	Cincinnati, O.	May 6
May 14.	Birmingham, Ala.	Apr. 22
May 15.	Kenosha, Wis.	Apr. 29
May 15.	Freeport, Pa. Adv. May 6.	May 6
May 15.	Atlanta, Ga.	May 6
May 16.	Washington, D. C.	May 6
May 16.	Green Bay, Wis.	May 6
May 16.	Sharon Hill, Pa. Adv. May 16.	May 6
May 17.	Washington, D. C. Adv. Apr. 22, 29.	Apr. 22
May 17.	Amsterdam, N. Y.	May 6
May 18.	Mt. Carmel, Pa. Adv. Apr. 29, May 6.	Apr. 29
May 18.	Columbus, O.	May 6
May 19.	Steubenville, O. Adv. May 6.	May 6
May 19.	Puyallup, Wash.	May 6
May 20.	Marion, S. C.	May 6
May 25.	North Platte, Neb.	May 6
May 29.	Cincinnati, O.	May 6
May —.	New Britain, Conn.	Apr. 8

BRIDGES.

May 9.	St. Peter, Minn.	May 6
May 10.	Pembina, N. D.	Apr. 22
May 10.	Cleveland, O.	Apr. 22
May 10.	Lisbon, N. D.	Apr. 29
May 10.	Beeville, Tex.	May 6
May 11.	New York, N. Y.	Apr. 22
May 13.	Salem, Va.	May 6
May 15.	Park Rapids, Minn.	May 6
May 15.	Everett, Wash.	May 6
May 16.	Kingstree, S. C.	Apr. 29
May 16.	Cleveland, O.	May 6
May 17.	Cleveland, O.	Apr. 22
May 17.	Pittsburg, Pa.	Apr. 29
May 20.	Mitchell, S. D.	May 6
May 22.	New Rockford, N. D.	May 6
May 24.	Ellendale, N. D.	Apr. 29
May 25.	Zanesville, O.	May 6
May —.	New Britain, Conn.	Apr. 8

PAVING AND ROADMAKING.

May 9.	Delaware, O.	Apr. 22
May 9.	Atlantic City, N. J.	Apr. 15
May 9.	Peru, Ind.	Apr. 22
May 9.	Wellsville, N. Y. Adv. Apr. 22 to May 6.	Apr. 22
May 9.	St. Louis, Mo	Apr. 29
May 9.	Brazil, Ind.	Apr. 29
May 9.	Chicago, Ill.	May 6
May 10.	Ft. Greble, R. I. Adv. Apr. 15 to May 6.	Apr. 15
May 10.	Cincinnati, O.	Apr. 22
May 10.	Delaware, O.	Apr. 22
May 10.	Elmira, N. Y.	Apr. 29
May 10.	Pine Bluff, Ark.	Apr. 29
May 10.	Freehold, N. J., Adv. Apr. 29 to May 6	Apr. 29
May 10.	New York, N. Y.	May 6
May 10.	Lewiston, Idaho	May 6
May 11.	New York, N. Y.	Apr. 22
May 11.	York, Pa.	Apr. 29
May 11.	New York, N. Y.	May 6
May 12.	Washington, D. C. (2 prop.) Adv. Apr. 29 to May 6.	Apr. 29
May 13.	Cleveland, O.	Apr. 22
May 13.	Norwood, O.	Apr. 22
May 13.	Washington, D. C. Adv. Apr. 29 to May 6.	Apr. 29
May 13.	Seattle, Wash.	May 6
May 15.	Henderson, N. C. Adv. Apr. 29.	Apr. 29
May 15.	Celina, O.	Apr. 29
May 15.	Freeport, Pa. Adv. May 6	May 6
May 16.	Trenton, N. J.	May 6
May 16.	Washington, D. C.	May 6
May 16.	Upper Marlboro, Md.	May 6
May 17.	Terre Haute, Ind.	May 6
May 19.	Richmond, Va.	May 6
May 20.	**Ft. Mackenzie, Wyo** Adv. Apr. 29.	Apr. 29
May 20.	Washington, D. C. Adv. May 6.	May 6
May 22.	**Bluefield, W. Va** Adv. Apr. 29 to May 6.	Apr. 29
May 22.	Wyoming, O.	Apr. 29
May 22.	Canton, O.	May 6
May 22.	Elmira, N. Y. Adv. May 6.	May 6
May 27.	Ft. Ontario, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
May 29.	Cincinnati, O.	May 6
Jun. 1.	Owensboro, Ky.	Apr. 22
Jun. 2.	Cincinnati, O.	May 6
———	Grenada, Miss.	Apr. 29

POWER, GAS AND ELECTRICITY.

May 9.	Fulton, Mo.	Apr. 29
May 10.	Lyons, Kan.	Apr. 8
May 10.	Ft. Sheridan, Ill.	Apr. 29
May 10.	Red Bluff, Cal.	Apr. 29
May 10.	Franchise, Bristol, Va.	Apr. 29
May 12.	Pittsburg, Pa.	Apr. 22
May 13.	Marshall, Minn.	May 6
May 15.	Jewell City, Kan.	Mar. 18
May 15.	Louisville, Ky.	Apr. 29
May 15.	Edmonton, Alberta, N. W. Ter.	May 6
May 15.	New York, N. Y.	May 6
May 15.	Indianapolis, Ind.	May 6
May 17.	Oxford, Pa.	May 6
May 18.	Ashland, Va.	May 6
May 18.	Oswego, N. Y. Adv. May 6.	May 6
May 20.	Washington, D. C. Adv. May 6.	May 6
May 20.	Ft. Hancock, N. J.	May 6
May 22.	Philadelphia, Pa. Adv. May 6.	May 6
May 23.	Washington, D. C.	Apr. 29
May 26.	Kankakee, Ill.	May 6
May 31.	Washington, D. C. Adv. Apr. 29 to May 6.	Apr. 29
Jun. 1.	Spartanburg, S. C.	Apr. 29
Jun 3.	Cape Charles, Va.	Apr. 8
Jun. 6.	Sebastapol, Cal.	Apr. 22
Jun. 8.	Newport, Ky.	Apr. 29

BUILDINGS.

May 9.	Mech. Equip. U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18.	Mar. 18
May 9.	School, Phoenix, Ariz.	Apr. 22
May 9.	Pub. Bldgs., Concord, N. H.	Apr. 22
May 9.	Infirmary, etc., Steubenville, O.	Apr. 22
May 9.	Htg. Hospital, Fulton, Mo.	Apr. 29
May 9.	School, Seneca, Wis.	May 6
May 9.	School, Winnipeg, Man.	May 6
May 10.	Pub. Bldg., Norwalk, O.	Apr. 22
May 10.	School, Chamberlain, S. D.	Apr. 22
May 10.	Court House, Grundy, Va.	Apr. 22
May 10.	Light House, Portland, Ore.	Apr. 29
May 10.	Engine house, Pittsburg, Pa.	Apr. 29
May 10.	Pub. Bldgs., Prattville, Ala.	May 6
May 10.	Bus. Bldg., Altoona, Pa.	May 6
May 11.	P. O. Bldg., Laramie, Wyo.	Apr. 8
May 11.	Hospital Improv., Ft. Assinniboine, Mont.	Apr. 15
May 11.	School, Zuni, N. M.	Apr. 22
May 11.	School, Salem, N. J.	Apr. 22
May 11.	School plans, Sacramento, Cal.	Apr. 22
May 11.	Hospital, Cincinnati, O.	Apr. 22
May 11.	**Shelters, Brooklyn, N. Y.**	Apr. 29
May 11.	Hospital, Ft. Assinniboine, Mont.	Apr. 29
May 12.	Arsenal, Philadelphia, Pa.	Apr. 22
May 12.	Jail, Kountze, Tex.	May 6
May 13.	School, Des Moines, Ia.	Apr. 22
May 13.	Terra-cotta for War College, Washington Barracks, D. C., Adv. Apr. 15 to May 6.	Apr. 15
May 13.	Library, Celina, O.	May 6
May 15.	School, Port Arthur, Tex.	Apr. 1
May 15.	Post Bldgs., Ft. Sam Houston, Tex. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Univ., Wilberforce, O.	Apr. 22
May 15.	Hospital pav., Swinburne Island, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
May 15.	School, Mason, Ala.	May 6
May 15.	Post bldgs., Portsmouth, N. H.	May 6
May 15.	School, Fall River, Mass.	May 6
May 15.	Schools, Brooklyn, N. Y.	May 6
May 15.	School, New Brighton, S. I., N. Y.,	May 6
May 15.	School, New York, N. Y.	May 6
May 15.	Engine house, Montgomery, Ala.	May 6
May 15.	School, Herford, N. C.	May 6
May 16.	Pub. Bldg., Elkhart, Ind.	Apr. 15
May 16.	Court house, Utica, N. Y.	May 6
May 16.	Pub. bldg., Lafayette, Ind.	May 6
May 16.	Post. bldg., Ft. Missoula, Mont.	May 6
May 17.	Pub. Bldg., Wash., D. C.	Apr. 22
May 17.	Hospital, Dayton, O.	Apr. 22
May 17.	Pub. Bldg., Ft. G. H. Wright, N. Y.	May 6
May 17.	School, Saltville, Va.	May 6
May 17.	Hospital, Kings Park, N. Y. Adv. May 6.	May 6
May 18.	Pub. Bldg., National Home, Wis.	Apr. 22
May 18.	Pub. bldg., San Francisco, Cal.	May 6
May 20.	School, Brooklyn, O.	Apr. 29
May 20.	Prison, Trenton, N. J.	May 6
May 22.	Post Bldgs., Prescott, Ariz. Adv. Apr. 15 to May 6.	Apr. 15
May 22.	P. O. Bldg., Oil City, Pa. Adv. Apr. 15, 22.	Apr. 15
May 22.	Post Bldgs., Wash. Barracks, D. C. Adv. Apr. 29 to May 6.	Apr. 29
May 22.	School, Austin, Pa.	May 6
May 22.	School, Ashland, Wis.	May 6
May 23.	P. O. Bldg., Owosso, Mich.	Apr. 22
May 23.	Hospital, Raleigh, N. C.	Apr. 20
May 23.	School, Cape Girardeau, Mo.	May 6
May 24.	P. O. Bldg., Pekin, Ill.	Apr. 20
May 24.	School, Corydon, Ia.	May 6
May 24.	Hospital, Jersey City, N. J.	May 6
May 25.	P. O. Bldg., Geneva, N. Y. Adv. Apr. 22, 29.	Apr. 22
May 25.	Post Bldg., Ft. du Pont, Del. Adv. Apr. 29 to May 6.	Apr. 29
May 25.	Post Hosp., Ft. Riley, Kan. Adv. Apr. 29 to May 6.	Apr. 29
May 25.	Church, Indianapolis, Ind.	May 6
May 27.	Post bldgs., Vancouver Bar., Wash.	May 6
May 27.	Post bldgs., Ft. Ethan Allen, Vt. Adv. May 6.	May 6
May 29.	Htg. P.-O. bldg., Kankakee, Ill.	May 6
May 29.	Light house, Tompkinsville, N. Y.	May 6
May 31.	P. O. Bldg., Allentown, Pa.	Apr. 20
May 31.	Boat house, etc., Philadelphia, Pa.	May 6
Jun. 1.	P. O. Bldg., Little Falls, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
Jun. 1.	Bank, Knoxville, Tenn.	Bay 6
Jun. 5.	Capitol. Frankfort. Ky.	Apr. 22
Jun. 5.	P. O. Bldg., Crawfordsville, Ind.	Apr. 29
Jun. 6.	P. O. Bldg.. Rockhill, S. C.	Apr. 20
Jun. 7.	P. O. bldg., Reno, Nev.	May 6
Jun. 8.	P.-O. bldg., Amesbury, Mass. Adv. May 6.	May 6
Jun. 10.	Schools, Alaska	May 6
Jun. 10.	**Court house, Plaquemine, La.** Adv. Apr. 29.	May 6
Jun. 12.	Capitol plans, Boise, Idaho	Apr. 22
Jun. 15.	Court House plans, New Orleans, La. Adv. Apr. 29.	Feb. 25
Jun. 15.	Synagague plans, Houston. Tex.	Apr. 15
Jun. 15.	Court House plans, New Orleans, La.	Apr. 22
Jun. 15.	Pub. bldg., Honolulu, H. I.	Apr. 29
Jun. 20.	School, Dillon, Mont.	Apr. 15
———	School plans. Needham, Mass.	Apr. 22
———	Jail, etc.. Beaufort. N. C.	Apr. 15
———	Bus. Bldg., Mineral Wells, Tex.	Apr. 20
———	Factory. Corinth. Miss.	Apr. 20
Aug. 1.	**Y. M. C. A. Bldg., Spokane, Wash.**	Apr. 29

MISCELLANEOUS.

May 8.	Dredging, Newport, R. I. Adv. Apr. 15 to 29.	Apr. 15
May 9.	Supplies, Washington, D. C.,	Apr. 22
May 9.	Iron, etc., New York, N. Y.	Apr. 29
May 9.	Dock, Chicago, Ill.	May 6
May 9.	Supplies, Panama	May 6
May 10.	Ditch, Stevens Point, Wis.	Feb. 25
May 10.	Elevator, New York, N. Y.	Apr. 8
May 10.	Earth spreaders, etc., Panama Adv. Apr. 15 to May 6.	Apr. 15
May 10.	Supplies, Washington, D. C.	Apr. 22
May 10.	Cable, Charlevoix, Mich.	Apr. 22
May 10.	Dredging, Newport, R. I. Adv. Apr. 22 to May 6.	Apr. 22
May 10.	Retaining wall, Wheeling, W. Va.	Apr. 29
May 10.	Conduits, Brooklyn, N. Y.	May 6
May 11.	Paints, garbage carts, etc., Panama Adv. Apr. 22 to May 6.	Apr. 22
May 11.	Stone, Port Harford, Cal.	Apr. 22
May 11.	Drain, Auburn, Ind. Adv. Apr. 22, 29.	Apr. 22
May 11.	Stone, etc., Brooklyn, N. Y.	Apr. 29
May 11.	Bulkhead, Ft. Moultrie, S. C.	May 6
May 11.	Retaining wall, Cleveland, O.	May 6
May 12.	Removing rock, New York, N. Y. Adv. Apr. 15 to May 6.	Apr. 15
May 12.	Supplies, Panama (2 prop.) Adv. Apr. 15 to May 6.	Apr. 15
May 12.	Drain, Pittsburg, Pa.	Apr. 22
May 12.	Filing equip., Columbia, S. C.	Apr. 29
May 13.	Supplies, Panama (2 prop.) Adv. Apr. 15 to May 6.	Apr. 15
May 13.	Pier improv., Buffalo, N. Y. Adv. Apr. 15 to May 6.	Apr. 15
May 13.	Rip rap, Ashland, Wis. Adv. Apr. 22 to May 6.	Apr. 22
May 15.	Dredging, Providence, R. I. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Sanitary fixtures, etc., Panama (2 prop.) Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Excav., Chicago, Ill., Adv. Apr. 22 to May 6	Apr. 22
May 15.	Channel excav., Erie, Pa. Adv. Apr. 22 to May 6.	Apr. 22
May 15.	Supplies, Watervliet, N. Y.	Apr. 29
May 15.	Dredging, Ottawa, Ont.	May 6
May 15.	Pier, etc., New York, N. Y.	May 6
May 15.	Retaining wall, New York, N. Y.	May 6
May 16.	Supplies, Washington, D. C.	Apr. 15
May 16.	Dredging, etc., Milwaukee, Wis. Adv. Apr. 22 to May 6.	Apr. 22
May 16.	Supplies, Wash., D. C.	May 6
May 16.	Cement, Wheeling, W. Va. Adv. Apr. 22 to May 6.	Apr. 22
May 16.	Retaining wall, Trenton, N. J.	May 6
May 16.	Pine, etc., Panama. Adv. Apr. 15 to May 6	Apr. 15
May 16.	Transit tunnel, Boston, Mass. Adv. Apr. 29 to May 6.	Apr. 29
May 16.	Cranes, Panama Adv. Apr. 29 to May 6.	Apr. 29
May 16.	Park improv., Cleveland, O.	May 6
May 17.	Fire escapes, Wash., D. C.	Apr. 22
May 17.	R. R. tools, etc., Panama Adv. Apr. 22 to May 6.	Apr. 22
May 17.	Supplies, Watertown, Mass. Adv. Apr. 15 to May 6.	May 6
May 17.	Dredging, New London, Conn.	May 6
May 18.	Brick, screens, etc. Panama Adv. Apr. 22 to May 6.	Apr. 22
May 18.	Explosives, Panama, Adv. Apr. 22 to May 6	Apr. 22
May 18.	Wharf, San Francisco, Cal.	May 6
May 18.	Retaining wall, Wheeling, W. Va.	May 6
May 19.	Jetty work, Savannah, Ga. Adv. Apr. 22 to May 6.	Apr. 22
May 19.	Pine, Panama. Adv. Apr. 22 to May 6	Apr. 22
May 19.	Pier, Cleveland, O.	Apr. 22
May 19.	**Lock gates, etc., Pittsburg, Pa.**	Apr. 29
May 19.	Drainage, Havana, Ill.	May 6
May 20.	Breakwater, Buffalo, N. Y. Adv. Apr. 22 to May 6.	Apr. 22
May 20.	Dam, Rock Island, Ill. Adv. Apr. 22 to May 6.	Apr. 22
May 20.	Dam improv., Pittsburg, Pa.	Apr. 29
May 20.	Dredging, Milford, Conn. Adv. May 6.	May 6
May 22.	Pier, Erie, Pa. Adv. Apr. 29 to May 6.	Apr. 29
May 22.	Dredging, Cleveland, O.	Apr. 29
May 22.	Supplies, Philadelphia, Pa.	May 6
May 23.	Supplies, Washington, D. C.	Apr. 22
May 23.	Breakwater, Block Island, R. I. Adv. Apr. 29 to May 6.	Apr. 29
May 23.	Dredging, Block Island, R. I. **Adv. Apr. 29 to May 6.**	Apr. 29
May 23.	Remov. rock, Buzzards Bay, Mass. Adv. Apr. 29 to May 6.	Apr. 29
May 23.	R. R. supplies, New Orleans, La.	Apr. 29
May 24.	Pipe, tools, etc., Panama. Adv. Apr. 29, May 6.	Apr. 29
May 24.	Pier, Baltimore, Md. Adv. May 6.	May 6
May 25.	**Levee work, Memphis, Tenn.** Adv. Apr. 29 to May 6.	Apr. 29
May 25.	Drain, Marion, O. Adv. May 6.	May 6
May 26.	Dredging, Buffalo, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
May 27.	Lock, etc., Pittsburg, Pa. Adv. Apr. 29 to May 6.	Apr. 29
May 29.	Lock gates, etc., Nashville, Tenn. Adv. Apr. 29 to May 6.	Apr. 29
May 29.	Excav., Boston, Mass. Adv. Apr. 29, May 6.	Apr. 29
May 29.	Dredging, Portland, Me. Adv. May 6.	May 6
May 29.	Lock, Plaquemine, La. Adv. May 6.	May 6
May 29.	Sea slope, etc., Buffalo, N. Y. Adv. May 6.	May 6
May 31.	Dredge, Galveston, Tex. Adv. May 6.	May 6
May 31.	Docks, etc., Cincinnati, O.	May 6
May 31.	Dredging, Mobile, Ala. Adv. May 6.	May 6
Jun. 1.	Telephone system, Glendive, Mont., Adv. Apr. 29, May 6.	Apr. 29
Jun. 2.	Channel, Grand Rapids, Mich. Adv. May 6.	May 6
Jun. 5.	Timber, Nashville, Tenn.	May 6
Jun. 8.	Dikes, Augusta, Ga. Adv. May 6.	May 6
Jun. 8.	Drainage canal, Onawa, Ia.	May 6
Jun. 15.	Pole and telephone line, Minidoka, Idaho. Adv. Apr. 22 to May 6.	Aur. 22
Jun. 15.	Wharf, etc., Honolulu	Apr. 29
Jun. —.	Dam, Iowa City, Ia.	Apr. 22
Jul 1.	Municipal St. Ry. system, Chicago, Ill. Adv. Apr. 15 to May 6.	Apr. 15
Aug. 26.	**Coal plant, Olongapo, P. I.**	**May 6**
Sep. 1.	Steel and iron, Sydney, N. S. Wales. Adv. Apr. 8, 22, May 6.	Apr. 22
———	R. R. work, Oglethorpe, Ga. Adv. Apr. 29 to May 6.	Apr. 22
Apr. 2, '06.	Harbor Work, Valparaiso, Chili. Adv. Apr. 22 to May 6.	Apr. 29